n Steel by H. Adlard. Printed by W. O. Knight.

MR. PETER NICHOLSON,

Author of the

BUILDER AND WORKMANS NEW DIRECTOR, &c. &c. &c.

Engraved for the fourth Volume of the Mechanics Magazine.

From an original Painting in his own Possession.

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MECHANICS'

MAGAZINE.

VOLUME FOURTH.

"The Mechanics' Magazine (most ably edited by Mr. Robertson) has, from its establishment, had an extensive circulation; and it communicates, for Three Pence a Week, far more valuable information, both scientific and practical, than was ever before placed within the reach of even those who could afford to pay six times as much for it."—*Mr. Brougham's Practical Observations on the Education of the People.*

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PREFACE

TO

VOLUME THE FOURTH.

The still increasing success which attends our humble endeavours, to enlighten the minds, and stimulate the inventive powers, of the productive classes of the community, is a source of many gratifying reflections. It serves to assure us, not only that we continue to perform an acceptable service satisfactorily, but that it must, even already, be conferring its benefits on the nation. Mechanical invention, and not mere labour, is the great source of national wealth; and in proportion as we have contributed to rouse the former into action, and to assist its efforts, we must have substantially advanced the latter. Labour, to be productive of abundance, must be skilfully directed. "The simple labourer," as Dr. Alderson, the enlightened and respected President of the Hull Mechanics

Institute, has justly observed, "can do no more than supply the immediate wants of himself and family, however earnestly or assiduously he may be employed in collecting what is spontaneously produced; but wealth is that additional product which the labourer, by the assistance of mechanical invention, is capable of creating." But for mechanic invention, man would have been still, as in the earliest stages of society, "grubbing in the earth for roots to obtain a scanty meal, or quarrelling with his brother for a piece of dead game." But for mechanic invention, what would have become of "all our great men, our princes, and nobles of the land, who neither toil nor spin? They are but the ornaments that decorate the grand temple that wealth has pride in exhibiting; they only indicate wealth; they, with all their possessions, add nothing to the riches of this country—they owe all their consequence to the wealth created by mechanic invention; their estates do but furnish the raw material, out of which mechanic labour produces wealth, and from which, if their owners employed only simple labour, and relied wholly on their own hands to convert what they find into food, they could but procure enough, vast as their possessions may be, for a bare subsistence."

It has been said, indeed, that instead of the torch of knowledge, we shall kindle only that of envy. But when did it ever happen that knowledge made men worse? that the cultivation of peaceful pursuits

made men discontented and turbulent? The emulation which the light of Science calls into being is a spirit very different from that of envy. The one prompts men to aim at superiority in real worth—the other would reduce all to a dull and base equality. 'Let the Arts and Sciences remain as they are, since they yield us enough as they are,' is the wish of the one party; 'let them be improved, since they can never produce too much,' is the wish and prayer of the other. Men will never, perhaps, reach perfection, but they should be always aspiring after it; and the nation which employs most assiduously the greatest variety of means for the purpose, will be the surest of outstripping all others in the race. "Cherish," says M. de Boufflers, "the genius of invention in a country, and there you will establish an imperishable prosperity. Every discovery and invention that is made will exalt it amongst its competitors, and its superiority will increase exactly in proportion as the blessings of philosophy and peace are spread over the world."

To fill the higher orders of society with alarm because of the progress of the lower in intellectual improvement, is one of the expiring efforts of Ignorance to lengthen her reign upon earth. She would, by the help of Power, make cripples of those whom she can no longer "in leading strings retain." But never was any alarm more unfounded: the more the labouring classes are enlightened, the more clearly they must perceive the claims which the higher

orders have on their attachment and respect—the more inclined they will be to give a "hearing ear" to the following excellent lesson taught them by the same gentleman whose strong opinion of their importance we have already quoted. "Let us not," says Dr. Alderson, "decry the higher orders of society, or consider them as useless, because they are not productive labourers. No! without them the mechanic could not carry on his business to that certainty, nor with that security, which is absolutely necessary. We must have *watchmen* and *guards*. Besides, the very establishment of Kings, Lords, and Commons, soldiers, magistrates, and professional men, is of infinite use in the chain of national society. We are, each of us, stimulated to increased action; our inventive faculties are put upon the stretch; and we unremittingly exercise our talents in the hope of obtaining some of those distinctions in society which every establishment holds out as rewards to merit."

Happily, the alarms which ignorance would instil are shared by but few. The higher orders, generally, are favourable to the extension of knowledge of every description to every rank of people; and to not a few among them we owe our thanks for much active assistance in these pages to promote their peculiar object—the improvement of the mechanic classes.

It is still, however, to the contributions of Mechanics themselves, and to the practical knowledge

they have communicated, that the "MECHANICS' MAGAZINE" chiefly owes its pre-eminent usefulness among the publications of the day. We have to congratulate our Correspondents of this class, generally, on the marked improvement which has taken place in their style of writing since they were first encouraged to avail themselves of this medium of conveying their thoughts and observations to the world. In some instances it has been such as to excite our astonishment. We could mention more than one or two well-informed individuals whose first rude attempts at composition saw the light in the pages of the MECHANICS' MAGAZINE, and who already write with a facility, exactness, and even elegance, that would do honour to any work. Be these our triumphs! Be results like these our defence when blamed, as we have been, for giving too ready admission to the imperfect essays of young and uncultivated genius! The magnates of science may lord it, without invasion from us, over the domains of the erudite and profound; we shall be content to have it acknowledged that, by the encouragement of simple and useful inquiry, we have added to the number of practical philosophers!

November 1st, 1826.

MEMOIR

OF

MR. PETER NICHOLSON.

THE late Mr. John Rennie, the first civil engineer in this country since the death of Smeaton, Mr. John Brown, perhaps the first scientific and practical agriculturist in Scotland, and Mr. Nicholson, the subject of this Memoir, were all born within half a mile, and within a few years, of each other; they learned to read and write at the same school, and under the same master. The place of their birth was the parish of Prestonkirk, in the county of East Lothian; and the name of their schoolmaster Richardson, the brother of an architect of that name, who published several works, consisting of designs, a treatise on the different Orders of Architecture, &c. Mr. Nicholson was the youngest of the three; when he went to school, Mr. Brown had left, and Mr. Rennie was just about leaving it.

Young Nicholson, at a very early age, even before he went to school, evinced a strong mechanical genius, and also a turn for drawing whatever presented itself to him, whether of animated nature, or of works of art.

On the opposite side of a small river, on the northern bank of which his father's house stood, was a small mill for dressing barley; and at no great distance, on the same small river, were a saw, flour, and snuff mills; from which the ingenious boy was enabled to model many sorts of machines with considerable exactness and skill.

It is to be regretted, that while every attention is paid to the education of some young persons, who undervalue opportunity and refuse instruction, others, who have both the capacity and inclination to learn, are often deprived of the means, or, at least, but very scantily supplied with them. Young Nicholson was in the latter situation; three years' instruction being the most he ever had at the before-mentioned country school, which he left at the age of twelve. Although his scholastic instructions were very limited, yet being bent on inquiry, and decidedly of a mathematical turn, he made by his own efforts considerable progress. Having borrowed from another boy, much older than himself, a copy of Commandine's Euclid, translated by Cann, he soon made himself master of the first and second Books, and got as far as the 18th Proposition in the third; but the plate which contained the diagrams to which the demonstrations refer being wanting, he constructed the figures from the problems without the assistance of any copy.

At about the age of twelve, he assisted his father at his business of a stone-mason; but as he never could relish that occupation, his parents had too much good sense and natural affection to force his inclination, and he was, at the end of a year, bound apprentice to a cabinet-maker, in the neighbouring village of Linton, for four years, during which time he employed every spare moment in improving himself.

At the expiry of his apprenticeship he went to Edinburgh, to work as a journeyman, where he studied mathematics more generally from Ward's Introduction. As a reference from some of the books he had read excited an uncommon desire to acquire a knowledge of the fluxionary calculus, he went to a then noted bookseller, Mr. Bell, in Parliament-square, and looked over the prefaces and contents of several books, when the Introduction to Emerson's Fluxions determined him to give it the preference; but the scanty wages which he received for his labour being scarcely sufficient for necessaries, he had not the means of paying for it. Mr. Bell, however, wishing to give every encouragement to a young man in pursuit of knowledge, although a mere stranger, told him to take the book, and pay for it at his convenience, which accordingly was done.

Emerson's Treatise on Fluxions has been generally allowed to be the most difficult on this branch of analytical science; it was not long, however, before Mr. Nicholson obtained a complete knowledge of the first principles, and the pleasure which resulted from their application to so many sublime problems, so encouraged him as to make him surmount every other difficulty, in whatever part of the work his inclination led him to study.

Mr. Nicholson came to London about the age of twenty, and for some time pursued his favourite studies of the mathematical sciences at his leisure hours in the evenings; at length, however, he dropped the pursuit of analytical subjects, and continued to study geometry only, as being more congenial to his views.

About his twenty-fourth year he had given such proofs among his fellow-workmen of his knowledge in the geometrical constructions of carpentry and joinery, that many of them solicited to become his pupils; he therefore opened a school in Berwick-street for the instruction of young workmen. His success in teaching soon brought him a very great influx of pupils, raising him above the level of a mere journeyman; and this gave him leisure to invent and arrange the materials for a new and original treatise on carpentry and joinery, called "The Carpenter's New Guide," and published in 1792. The plates of this work were engraved by himself. Besides the improvement in various kinds of groins which are to be found in this work, he introduced the construction of spherical niches, both upon straight and circular plans. Before that publication appeared, no work on the practical parts of building had shown, generally, how the sections and coverings of solids were obtainable from their definitions. The principles went only to find the section of a right cylinder, perpendicular to a given plane, parallel to its axis and to the covering of such a cylinder, and that of the frustrum of a right cone. Some attempts to obtain the same result had, indeed, previously been made, but they were erroneous and abortive; and as they had not succeeded with the plane sections and coverings of simple solids, they could scarcely be expected to give rules for the construction of the intersection of any two surfaces, or curves of double curvature, of which the variety is almost infinite.

Besides Mr. Nicholson's own inventions, he has both simplified and generalized the old methods, which were only applicable to particular circumstances. His rules for finding the sections of a prism, cylinder, or

cylindroid, through any three given points, whether in or out of the surface of the body to be cut, enable workmen to execute hand-rails without difficulty, and from the least possible quantity of material. His principles on the intersection of solids extend to groins and arches of almost every description. The coverings of polygonal and circular domes had been exhibited in several prior publications on Carpentry and Building, but no author had ever shown how these coverings were to be formed without the actual plan, which might be very inconvenient to draw, on account of the great space it required: nor had any method for covering domes upon an elliptic plan been given. The "Carpenter's New Guide" is one of his first and most useful works: it has gone through seven editions, and is, we believe, still as much in request as ever.

The "Student's Instructor" was published immediately after the "Carpenter's New Guide," and was followed by the "Joiner's Assistant," a work abounding with useful information, either to those who might be employed to make working drawings, or in the superintendence of buildings. Here several of the articles which were slightly treated of in the "Carpenter's Guide," are more fully explained, and extended to sufficient length. Besides the designs of roofs actually executed which it contains, it was the first work that treated on the methods of forming the joints, hinging and hanging doors and shutters. It has now reached to the fourth edition.

The "Principles of Architecture," in three volumes, octavo, appeared in 1779; till which time, all publications on that subject were greatly deficient in mathematical principles. In the latter publication was introduced a System of Practical Geometry, containing many new problems of great utility to builders.

Mr. Nicholson was the first who noticed, in this publication, that Grecian mouldings are conic sections, and that the volutes of the Ionic capital ought to be composed of logarithmic spirals, for which he accordingly gave rules for the describing of arches, mouldings, and spirals, of so general a nature as to be applicable in all cases. He is considered to have been the first to show how to describe any number of revolutions between any two given points in a given radius, in which the centre of the spiral was given; and thus he generalized the principles of De L'Orme and Goldman, whose methods were limited to three revolutions, and the eye of each of their volutes to one-eighth part of the whole length. This work was also the first that contained universal methods for projecting plans and elevations, with the method of finding their shadows.

Mr. Nicholson returned to Scotland in the year 1800, and, after staying a few months in his native village, went to Glasgow, where he practised with honour and reputation as an architect. Among the numerous edifices executed in and about that city from his designs, and which are esteemed classical models of taste by those who are best qualified to judge, were Carlton Place, an addition to the College Buildings, the wooden bridge over the River Clyde, and the town of Ardrossan, in Ayrshire, designed as a bathing-place at the request of the Earl of Eglinton.

In the year 1808, Mr. Nicholson removed to Carlisle, in Cumberland, having been appointed architect for the new Court Houses, then begun,

from designs given by Mr. Telford, the celebrated civil engineer, who recommended him to that situation, and as an architect for the County of Cumberland. Mr. Nicholson returned to London in 1819, when he commenced his "Architectural Dictionary."

His book of "Mechanical Exercises" was produced soon after his return to London, the object of which is to give a familiar description of such parts of a building as are susceptible of being explained without the aid of geometrical lines.

In April, 1814, the Society of Arts voted to Mr. Nicholson their gold Isis medal, for a new improvement in hand-railing; and in May (the same year) that Society rewarded him with the sum of twenty guineas, for the invention of the *Centrolinead*.

In the year 1815 he was rewarded with the silver medal of the same Society, for the invention of another *Centrolinead*, which is now brought into general use amongst those artists who make perspective drawings in architecture and machinery.

The numerous articles which his "Architectural Dictionary" contained led him to many curious investigations, and induced him once more to turn his attention to analytical science, the result of which was, that during the publication of that work he produced a small tract on the "Method of Increments," "Essays on the Combinatorial Analysis," and his "Rudiments of Algebra," all within the short space of two years. The last of these three works was published on the 1st of July, 1819, and the "Architectural Dictionary" was completed about two months afterwards.

Mr. Nicholson's "Essays on Involution and Evolution" were honoured with the approbation of the French Institute and Royal Academy of Sciences. That work, and his "Analytical and Arithmetical Essays," were published in the year 1820.

Mr. Nicholson's latest production is entitled, "The Builder and Workman's New Director," from a Memoir prefixed to which we have extracted our present brief notice of the ingenious author. This work was called for by the great improvements that have been recently made in every branch of architecture with regard to geometrical construction, and is one of his ablest and most complete performances. It embodies as much of Geometry, Conic Sections, Trigonometry, Projection, and Perspective, as will enable the student to comprehend with facility, and represent with accuracy, all the constructive departments of building, with the application of those principles to Masonry, Carpentry, Joinery, and Hand-railing.

The whole of Mr. Nicholson's active and scientific labours have been directed towards applying science to useful purposes—an object beyond all praise, being generally too much neglected by men who are given to study.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 85.] SATURDAY, APRIL 9, 1825. [Price 3*d.*

"If we examine our own feelings, and judge of Science by its influence on ourselves, we shall be obliged to confess, that although less obviously, it is, in fact, as much recommended to us by the pleasures to which it ministers, as those Arts that we regard as entirely devoted to the excitement of agreeable emotions."—*Ferro on the Fine Arts.*

WARPING VESSELS UP RAPIDS.

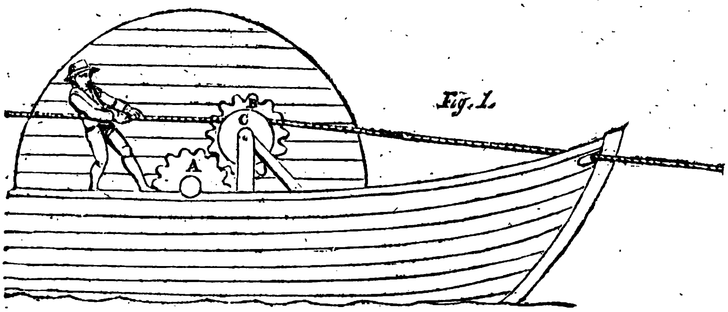


Fig. 1.

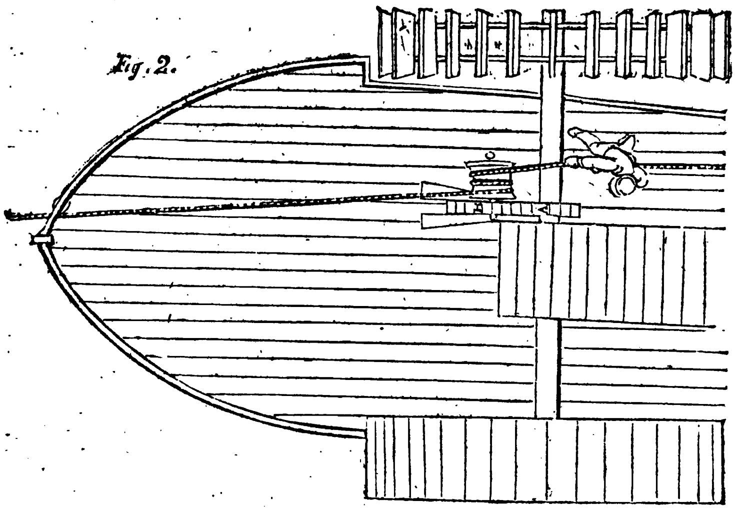


Fig. 2.

WARPING VESSELS UP RAPIDS.

SIR,—I observe, in a Number of the Mechanics' Magazine for January, a Plan for Warping Vessels up Rapids, and now in operation on the Delaware. The principle is precisely that which occurred to me five years ago, when in Canada, and which, by the united action of machinery and the current, I wished to apply to steam-vessels navigating the St. Lawrence. I accordingly inserted an advertisement in the "Canadian Courant," published in Montreal, addressed to the proprietors of those vessels.

Allow me, Sir, to present you with the following detail, under the expectation that you will insert it, and, by placing it on record, do me that justice which I consider is due to me :—

"To the Proprietors of Steam-Boats navigating the St. Lawrence.

"The Proprietors of Steam-Boats navigating this river, are respectfully informed that the subscriber is possessed of a plan by which the ascent of those vessels up the rapid below this city, may be greatly expedited. The principle is such, that its extension may greatly improve the mechanical navigation of the rivers of America, open new routes for its application, and, by giving it action where it has heretofore been dependent on the operation of towing, render it superior to natural impediments.

"T. H. BELL.

"Montreal, June 20, 1820."

I explained the plan to the Editor of the "Canadian Courant," Mr. Driscol, and the following are his remarks, which appeared in the same Paper :—

"INVENTION.—An ingenious person in this city has lately favoured us with a description of an addition to the present machinery of a steam-boat, by which those vessels may be made to stem currents hitherto impassable. It is well known that, in currents of a certain rapidity, the mechanical power becomes totally ineffective, the descent of the water being quicker than the revolution of the paddles. In order to ascend, recourse must, therefore, be had to cattle or manual labour. To obviate this inconvenience is the intention of the present improvement, it being calculated to propel a steam vessel *twenty-five yards per minute*,* in any current, the mechanical power increasing as the velocity of the water increases. Though not deeply versed in mechanics, so simple is the principle, we venture to predict that it will be found to answer all that is above attributed to it; an ingenious mechanic, not the inventor, being confidently of the same opinion."

The above advertisement appeared for some weeks, but was unnoticed by those to whom it was addressed, and I never again agitated it until my return to England, when, still considering it to be the greatest improvement that could be made in the mechanical navigation of American rivers, and highly desirable on the St. Lawrence, I sent a drawing and description to the Society of Arts, but without any view to a reward; for, to be able to add a single fact to science, is, I consider, a sufficient remuneration for the trouble of its discovery.

The following is a copy of my letter which accompanied the drawing, and the Secretary's reply :—

"Alnwick, June 8, 1822.

"SIR,—I beg leave, through you, to submit the enclosed drawing of an improvement in mechanical navigation, to the inspection of the Society for the Encouragement of Arts, &c.

"In my passage from Quebec to Montreal, in November, 1819, I observed that the power of the engine became totally ineffective in a current called *Sainte Marie*, a little below the city of Montreal. In consequence, recourse was had to cattle and manual labour to tow the vessel against the stream. It occurred to me, at the instant, that the power of the engine might be applied to wind the vessel up, or to render her automatic in any current, by a very simple arrangement of machinery, and an arm, as it were, be added to mechanical navigation. To effect this I would fix the cog-wheel, A, on the axle of the water-wheels, which would drive the wheel, B, and its concentric stream, or drum, C. At the head of the current, or a little above where the engine would be sufficient to impel the vessel, I would sink a kedge, with a buoyant hawser attached, to remain floating in the stream. This hawser being grappled on board, and applied to

* This remark supposes the paddle-wheels to perform 25 revolutions per minute, and the diameter of the drum to be only one foot.

the drum, C, one man or more taking it off (in the manner represented in the drawing), the vessel would herself ascend the current with a velocity proportioned to the revolutions of the water-wheels and the diameter of the drum. I may observe, that the current itself would assist the engine, and thus the *very impediment to the navigation be made one of the means of overcoming it.*

"T. H. Bell.

"P. S. In situations such as the current Sainte Marie, a kedge would be unnecessary, for the hawser could be fastened on shore, and two, applied alternately, would haul up the vessel. This principle of motion might be otherwise usefully extended. One application, perhaps of some magnitude, would be its adoption on canals, where the action of water-wheels is injurious to the banks. Boats, in canals, which at present are dragged by horses, might be towed, several together, by a single coiling-boat, driven by steam or horse-power. Hawsers might be made any length, and, where the canal was winding, be retained in their proper position by rollers placed along the banks.

"Arthur Aikin, Esq."

"Society of Arts, &c.
"Adelphi, London, Dec. 3, 1822.

"Sir,—I am directed to inform you, that your Plan for Warping Steam-Boats up Rapids has been considered by a Committee appointed for the purpose, and their opinion confirmed by the Society; the result of which is, that your endeavours, in this instance, are not entitled to their reward, but that they consider themselves obliged to you for your good intention and exertions.

"Arthur Aikin, Sec.

"Mr. T. H. Bell."

I remain, Sir,
Your most obedient servant,
Thomas H. Bell.

Alnwick, March 4th, 1825.

[The principle of Mr. Bell's plan is evidently the very same as that of Colonel Clark (described in our 71st Number), whose success, in reducing it to practice, furnishes the best commentary that can be offered on the soundness of the judgment passed upon it by the Society of Arts.—Edit.]

PURIFYING COAL-MINES.

Sir,—I give "A Staffordshire Farmer and Land-Drainer" (as your Correspondent, at page 317, Number 71, of your Magazine, calls himself) full credit for his humanity, but I am afraid his plan for airing Coal Mines will be of no farther use than to inform his practical readers that he has never been in one.

It is certainly true, that hydrogen gas, in a state of quiescence, floats at the top of atmospheric air, and is found at the roof or upper part of a mine; but when there is a current of fresh air passing through the workings of a mine, as must be the case if they are to be kept pure, it is well known that these gases mix and render a mechanical separation impossible. Had it been otherwise, this gas would have been innoxious, as it is the combination that makes it so explosive.

To a practical reader it would be worse than waste of time to enter into a refutation of your Correspondent's plan; I will content myself with making a remark or two, *en passant*, on some of his means of carrying it into effect. In the first place, as to "boring upwards." The operation of boring is done by chisels and inflexible iron bars or rods, called boring-rods, about three feet long, with alternate screws and sockets at the ends; the uppermost one having a cross-head or handle to it, for the convenience of the workman. These rods are of considerable weight, and this weight, when they have bored a few yards down, is the power applied to drive the chisel into the stone below; the workmen's employment being to raise them a little way out of the hole, and, after turning them partially round, to let them descend by their own weight. Now, how your Correspondent could imagine that a ton or more weight of rods could be held in a vertical position, to bore upwards, I am at a loss to imagine. Boring upwards is certainly done to explore dikes, &c. for a few feet, but beyond that it is found impracticable.

With regard to your Correspondent's strong box, &c. it is so absurd that I only notice it to remark, that the most general cause of explosion in coal-mines is the falling of strata composing the roof of the mine, which stops up the air-courses, and

generally brings with it a quantity of hydrogen, contaminating the whole mine, and preventing the atmospheric current from circulating. In these cases, if fire is introduced amongst it before the fresh air is taken from the shaft, an explosion is the inevitable consequence—an explosion of so tremendous a nature, that the 'Land-drainer's strong box,' I am afraid, would not be able to resist it.

If I might be allowed to offer a few hints to the ventilators of collieries, they would be—

1. Never allow your air to traverse too great an extent of workings, particularly old ones; but let your downcast and upcast shafts be connected by shorter ways than is generally done. Many accidents I could mention have occurred from want of this precaution, and I am afraid the only plea for the neglect that can be made is—the saving of expense.

2. Never trust too much to one furnace. If your mine be foul, divide your air, place two furnaces near your upcast shaft, and keep your two currents from communicating till they have passed over the fire.

3. Make all your air-courses large, and take particular care that your stoppings, brattin,* &c. be tight.

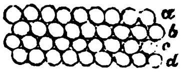
I am, Sir,
Your obedient servant,
E. B. C.

H——, Durham.

ON THE HYDROSTATICAL PARADOX, WEIGHT OF THE ATMOSPHERE, THE CENTRE OF GRAVITY, AND THE SYPHON.

Sir,—Seeing that none of your numerous Correspondents have undertaken the solution of the question on the Hydrostatical Paradox, I will venture to offer my opinion, and endeavour to account for the phenomenon in the most concise, simple, and reasonable manner I possibly can, that it may be fully intelligible to the *whole* of your readers. I should wish to impress the following facts on their minds, before I proceed to the explanation of one of the most singular properties of fluids:—

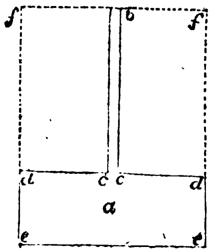
The force of gravity, or the attraction of the earth, which constitutes the *weight* of matter, is only exerted perpendicularly *downwards*, or in a direction tending towards the centre of the earth; this force produces different effects on a fluid than it does on a solid body, on account of the different property of the particles of which it is composed. The particles of a solid body *attract* each other (called the attraction of cohesion), and it is this property that constitutes its *solidity*, while those of a fluid *repel* each other; consequently they are unable to support themselves, and will, if not confined, extend themselves in every direction till they arrive at a level.



Suppose a body of water to be composed of numerous strata of inconceivably minute globular particles (see the above figure): as I have shown that these particles repel each other, the attraction of gravitation must exert itself on each particle separately; consequently the particles of stratum *a* will press on those of *b* with their own weight or gravity only, and those of stratum *b* will press on those of *c* with the weight of both *a* and *b*, and so on to the last stratum, which will support the weight of all the others; each particle of stratum *a* pressing on the two immediately under it, and each particle in stratum *b* partially pressed on by the two particles above it, as shown by the figure. Now, any particle in any of these strata may be considered as pressing *upwards*, *sideways*, &c. with the *same* force as it is pressed on by the particles *above* it, on account of the resistance occasioned by the repelling property of that particle, which makes it endeavour to escape the pressure. But when it presses *downwards*, *its own weight or gravity must be added*; consequently it must press downwards *the weight of the particle more* than it does in any other direction. Hence arises the increased pressure of every stratum from top to the bottom. The *horizontal extent* of a body of water has nothing to do with this *vertical* pressure, for, if the first or top stratum extend many square miles, the particles of which it is composed *cannot* press more on the second stratum than they would in a small tube, because a particle in the second stratum will only be partially pressed on by the two above it, and the weight or gravity of these two particles is the same in both

* Brattin is a deal partition, to direct the circulation of the air.

cases. Hence it follows, that a body immersed two inches deep in the *sea*, will not be pressed on with a greater force than if it were immersed the same depth in a *basin of water*.



I will now endeavour (as briefly as possible) to account for the phenomenon in question.—Let *a* (in the above figure) be a vessel, *b c* a tube fitted to it, and filled with water to the top, *b*; the upper stratum of particles, from *c* to *d*, will be pressed on with the same force as those from *e* to *c*; because the column *b c*, meeting with these particles at *c*, presses them *outwards* or *sideways*, and, as they *cannot escape the pressure*, on account of the top and sides of the vessel, they *must* therefore *exert the same force downwards* as those from *c* to *c*; consequently the bottom, *e e*, will be pressed on with the same force as it would if the vessel were made of the bulk of *e e*, *f f*, and filled with water to the top.

I will now notice the question on the Weight of the Atmosphere (page 332), as it is, in some measure, connected with the foregoing subject; I will also include the following one, and endeavour to answer them both together.

How is it that the atmosphere is thicker or more dense in warm weather than in cold, when, from what we know of heat, it possesses the property of *rarefying* air?

To answer these questions I will first give you my opinion of the nature of the heat we receive from the sun. I do not believe that the sun is a *body of fire* (which is the opinion of many), but that it is an opaque body, like our earth, surrounded by a *luminous atmosphere*, the rays of *light* from which, mixing with *our* atmosphere, produce the heat that we feel;* thus, then, the heat we feel, as *proceeding from the sun, is not of the same nature* as the heat proceeding from a *fiery* body.

If we suppose, then, that the rays of the sun, wherever they shine on our earth, possess the property of *accumulating* the particles of our atmosphere, *both* questions may be easily answered. In this supposition I must be allowed to differ with C. D. Y., as I think the atmosphere, where the sun shines most, *is* accumulated, and, consequently, *increased* both in height and density.

I must yet beg a little more room, just to notice the question on the Syphon (page 286). The reason is, because the *depth* of the water is greater in the *long* leg than in the *short* one; it is, therefore, of *greater pressure* at the *extremity* of the leg, consequently the fluid descends, because it *overbalances* the pressure at the extremity of the other leg. As there *cannot* be a vacuum between the legs, the weight of the atmosphere pressing on the surface of the fluid in which the shorter leg is immersed, supplies the discharge by forcing it up the short leg.

If I have stated any thing that is incorrect, nothing would give me greater pleasure than in being set right by some of your better-informed Correspondents.

I cannot conclude without bestowing my warmest approbation on your valuable and useful Magazine, for thus encouraging useful and scientific inquiry; for directing the attention of the middling and working classes to subjects which otherwise, perhaps, they would never have thought of; and for affording, to *all*, a better medium through which to express their wishes, thoughts, and experience, than had existed before its commencement.

I remain, Sir,
Yours very respectfully,
J. E. COOMBS.
Bath.

SIR,—Should the following answers to your Correspondent, + W. X. (p. 285, vol. III.) appear worthy a place in your useful Magazine, I should feel much obliged by their insertion.

First. Why an additional pint of water will have the effect of bursting a hogshead filled with that fluid, if introduced by a small tube of sufficient height?

No part of any confined body of water (excluding the consideration of its own

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* As I never *believe* any thing, except I am *convinced* in my own mind of the *reasonableness* of my belief, I could adduce many arguments in favour of this hypothesis, but will not now take up more of your valuable room than what is necessary to the explanation of the present question; however, should any of your Correspondents deem it requisite, I would gladly resume this subject, and give my reasons and arguments, which would, I think, render the *truth* of what I have already said *beyond a doubt*.

gravity) can be made to exert a greater or less pressure than each of its remaining equal parts; consequently, if the water in the tube compress a given weight upon half an inch of the surface of the water in the hogshead, there will be an instant counter-exertion of an equal force by each remaining half-inch of the whole surface; and the effect would be the same were a solid body employed, of a proper construction, in place of the fluid. Thus, take any closed vessel, of sufficient strength, containing, say an internal surface of 100 square inches, fill it with water, and let a small cylinder, with a piston, be properly inserted, the end of the former circumscribing, say an area of half an inch, and the latter exactly fitting. Then, upon the piston, a force of fifty pounds being compressed, there will be an instant exertion of ten thousand pounds within the whole of the confining vessel; or, if instead of this apparatus, a male and female screw be used, of one-sixteenth thread, and an inch in diameter, put into effect by a crow or handle 12 inches in length, with a force of 50 pounds, then will the amazing pressure of 60318,72 pounds be sustained by every $\frac{7854}{10000}$th parts of an inch, or upwards of seven millions and a half of pounds, or three thousand three hundred and fifty tons within the small compass of little more than four cubic inches—a force that may be yet increased, *ad infinitum*, by merely lengthening the lever applied to the screw. With this, as a momentary power, perhaps steam, gas, or gunpowder, can never be made to compete; and may it not, in time, be found in human ingenuity to make it, as a power, answer the purposes of all? At least it appears intended to serve the purposes of man in some way yet unknown, else why is such omnipotence placed in his hands?

To the remaining part of his first question, Why an half-inch column, of ten feet in height, should have greater effect than a three-inch column of five feet in height? + W. X. may find his answer in the law in hydrostatics, of which he seems to be aware, namely, that all columns of water, however varying in circumference, being of the same altitude, have equal pressure on equal spaces at equal heights. But, doubting my ability to be sufficiently clear by mere words, I beg leave to introduce the following figures:—

Fig. 1

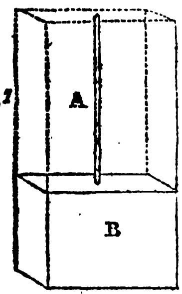


Fig. 2

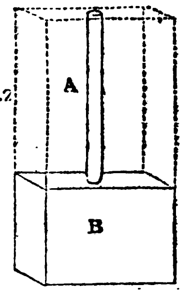


Fig. 3

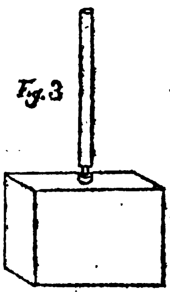


Fig. 4.

Let A (fig. 1) represent a tube inserted into a vessel, B, filled with water, the lower end of which tube circumscribes the space of half an inch. Let A (fig. 2), in like manner, be a tube, enclosing, by its lower end, an area of three inches. Now, suppose the two vessels, B, B, to contain equal quantities of water, and that the tubes, A, A, being of equal height, are also filled with that fluid; then, although the tube A (fig. 2) contains six times as much water as the other, the weight of that water being exerted on six times as much space, both vessels must sustain an equal internal pressure. Consequently, if the greater column were only half as light, it could have only half the force of the lesser. But if A (fig. 2) be closed at the bottom, and have a short peg attached to it (as represented in figure 3), the area of the bottom of which peg being half an inch, and it be properly inserted into a vessel of equal size with the two former, then will the internal pressure sustained by such vessel be six times as great as before the space being contracted five-sixths under the same weight. Also, if any given weight be impressed on the water in the tube of fig. 1, and an equal weight on that in the tube of fig. 2, then will that weight exert itself with six times greater force within the former vessel than within the latter, the space it is impressed upon being five-sixths less.

Suppose, again, that the sides of the two first vessels were raised, as represented by the dotted lines, to the height of the tubes, and then filled with water (the tops of the vessels, in the first state, being considered as taken away), the pressure on the bottoms of the vessels and on the sides, as high as they were at first, would be precisely the same as before; nor would it be greater were the horizontal dimensions of the vessels increased six thousand times, or any less if in an equal degree contracted; that is, it would not be any greater or any less on equal spaces at equal heights. For if two columns of water, A and B (fig. 4), communicate at bottom, though A be six times as large as B, yet will B sustain A, because all communicating columns of water will maintain their level; consequently, though B should be made as great as A, it would still do no more than sustain it. The column A, in the first case, not exerting the whole of its weight against the column B, but only that of a column equal to B, its remaining five equal columns being sustained by the parts of the confining vessel surrounding the bottom of the tube B; yet, on the other hand, the column B, though only a sixth part as large as A, does exert a force equal to the weight of its opposite column, because the force with which it presses upon the sixth part of the greater column is immediately counter-exerted by each of the remaining five parts on the internal surface of the confining vessel surrounding the bottom of the tube B, agreeable to the law before mentioned, that no part of any body of fluid can be made to sustain a greater pressure than each of the remaining equal parts of the same height, if unconfined, nor of any height (excluding the consideration of its own gravity) in a confined state. By the intervention of any solid body, as the peg in fig. 3, between a column of water and any other mass of water in a confined state, though that column, in a state of free communication, would impress only its natural weight, yet, by such intervention of a solid body, its force may be increased or diminished in an infinite degree by the diminution or increase of that part of the solid intervening body which presses on the confined mass of fluid, exactly fitting, as a matter of course, the opening of the confining vessel into which it is introduced, which, however, is only a different modification of the experiment described in the first part of this letter.

To conclude (which I beg pardon, Sir, I have not done long ago), it is not difficult to believe that a sphere of water at the centre, with a small column extended to the surface of our earth, need not be comparatively very great to put it in the power of the atom called man, to burst this stupendous world like a bubble, provided the matter enclosing the sphere and projected column be so compact as not to allow any portion of the fluid to insinuate itself into greater space without rending asunder the surrounding mass; probably the weight of the column only would be equal to such an effect; for, taking the semidiameter of our globe at 4000 miles, and deducting 250 miles for the semidiameter of the sphere of water, the column would impress a weight of 9,556,250 pounds upon every inch, and the whole force with which the sphere would be made to exert itself, in order to bring the column within its own circumference, would be 30,130,666,384,896,000,000,000 pounds, or 13,451,190,351,400,000,000 tons; on which grand hydrostatic principle may, probably, be accounted for the present geological appearance of our earth.

I trust + W. X. will be able to make make up, by his own reflection, for the brevity with which I am obliged to answer his two remaining questions. It is the change in the centre of gravity that gives preponderance to the pea of a steelyard, on removing it further from the fulcrum, and, to recover the equilibrium, either the fulcrum must be placed in the new centre of gravity, or an additional weight must be suspended at the other

end, in order to restore that centre to its old place. The centre of gravity, perhaps + W. X. is aware, is that perpendicular line in any body, the product of the weight and distance on each side of which is equal to the product of the weight and distance on the other; hence what is lost in distance is gained in weight, the reason of which is, that velocity is power; and the further from the fulcrum the extremity of a lever, the greater its velocity, which velocity gradually diminishes to the centre of motion; consequently the nearer the end of the steelyard you suspend the pea, the greater is the velocity by which you have to multiply its weight. It is the pressure of the air, not gravitation, that causes the phenomenon of the syphon; the greater weight of water in the longer leg giving the air pressing on the end of the shorter a proportional advantage over that pressing on the end of the former. It is this, + W. X., that "pulls the water down the good-natured leg."

I am, Sir,
Your very obedient servant,
J. W.

Hirwain Iron Works.

FIRE-PROOF AND PLANK FLOORS.

SIR,—The imperfection of the old construction of Floors for the purposes of machinery, has induced some people in this neighbourhood to alter the flooring system altogether; and instead of joists, flooring-boards, tiering underneath, &c. (of which they formerly consisted), two planks, of quite a different nature, have been adopted, viz. fire-proof and plank floors.

For the fire-proof floors, the columns and beam are made of cast iron, and are secured in their places with wrought iron bars, that traverse from beam to beam; upon a margin underside the beams spring the arches of brick-work; these are filled to a level on their upper side with rubbish, and are covered with flags or tiles.

For plank floors, iron columns and beams are used; but the beams are flat on their upper side for the planks to lay upon; three-inch planks are then jointed and ploughed on the edges, for the purpose of admitting slips of sheet-iron (called tongues) to enter half-way into each plank, so that no dust may get through from the upper side.

These are certainly improvements on the old plan, as they possess the advantages of stability, and deprive vermin of their harbours. The advantage of fire-proof floors are steadiness, durability, and saving the insurance: but then the first expense is great; they take up more head-room, and the tiles or flags with which they are covered are unhealthful to the operatives, on account of their coldness. The plank-floors, though they are both cheaper and firmer than those on the old plan, have nevertheless their disadvantages; for though the floor may be made, yet let the timber be ever so well seasoned, when the rooms are ready for use, and must be kept up to the required temperarure, the joists will open, and the floor becomes pervious to both dust and water, which, with the tremor produced by the machinery at work, creeps round the dowels or tongue, and the consequences are serious to the machinery underneath. Besides, when the floor has become so deteriorated as to require repairing in the passages, the whole length of the planks must be taken up, from beam to beam, which will be attended with bad consequences to any machinery that may stand upon them, or to any fixtures underneath.

These considerations have induced me to turn my attention to this subject. I propose that, instead of three-inch planks, one and a half shall be used, laid upon iron beams, in two courses, one upon another; they shall both stretch the same way, and the upper boards shall break the joints of the lower; underneath the upper, and above the lower joints, slips of sheet iron, about three inches broad, must be laid, and kept in their places with a few nails; it will be necessary to screw the boards together in several places, to give them firmness. When this floor is finished, the joints will be good, and remain so, whatever temperature they may be exposed to. They will have another advantage over the present plank-floors; when the upper course is done, they may be renovated without breaking through the floors.

Another improvement may easily be made in the iron columns. Let their diameter be as great as convenient, for the purpose of enlarging their internal capacity, and let each column in every room have a cock, or any other application, for the purpose of emission: there must be a cistern on the top of the building (in case of accidents by fire, or for any convenient purposes where water may be wanted), and this cistern must be attached to the lifting-pump of the steam-engine. It will be necessary that each column be connected either at top or bottom, so that the water may flow through the whole, and they must likewise have air-pipes attached to them. Now, suppose the columns to be five inches bore (which is common), and the building six stories high, the average height of the stories nine feet six inches, length ninety feet by forty-eight feet, it will then contain eighteen columns fifty-seven feet long each, making in the whole a column of water one thousand and

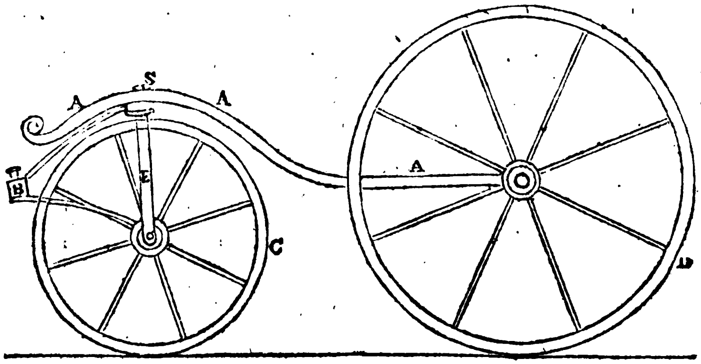
twenty-six feet long, and five inches diameter. Now, 5 × 5 × ,7854 = 19,635, area of bore; 19,635 × 57, length of column, = 13430,34, contents of one column; and 13430,34 × 18, = 872, imperial gallon. Here, then, is a capillary supply of water in every part of the building, which may be constantly maintained by feeding the cistern above from the engine. The importance of an immediate and convenient supply of water in every part, and in such extremities, needs no comment.

But they may be made useful in another way, viz. as ventilators. Let there be openings in each column, near the ceiling in every room, and let the whole of the columns connect with an horizontal pipe in the roof (made of sheet iron), and of sufficient capacity to give them draft. This pipe may be inserted in the chimney, provided it is made to dip a little before it enters, to prevent sparks or soot descending into the rooms; by this means the rooms may be ventilated from a great portion of dust, impure air, and superfluous heat, without opening the windows. Should this be doubted, let it be remembered that the sum of the orifices of the vertical pipes amounts to no less than 353,43 square inches.

I am, Sir,
Your most obedient servant,
R.

Manchester, Feb. 13th, 1825.

THREE-WHEELED CARRIAGE.



SIR,—May I request you to insert the above Sketch of the Under-part of a Three-wheeled Carriage in your interesting Magazine. I hope some of your numerous readers will please to examine it, and point out any improvement they may observe.

Description.

AAA is the perch, with a rise in front, to admit of a larger fore-wheel; C, the fore-wheel, attached to the perch by the iron frame, E, moving in a collar at S, to enable it to turn; B, the splinter-bar, to which the shafts may be attached; D, one of the hind-wheels. The perch is fixed on the centre of the hind axle. The body may be neatly set upon lancewood; and should the above be thought a practicable plan, I shall furnish you with a drawing of the carriage complete, which will be entirely duty free, and most likely very acceptable to your readers who have not an opportunity of visiting G. M. in Long Acre (vol. II. page 364).

I am, Sir,
A TRUE WELL-WISHER.
........, North Britain.

COMBINATION LAWS.

Our readers will do us the justice to remember, that when the proposal for abolishing the Combination Laws was under discussion during last Session of Parliament, we advocated at some length, and most unreservedly, the policy of the measure; but that, at the same time, we warned very distinctly those for whose relief it was intended, against a dangerous misapprehension into which they were likely to be led by the language used by certain individuals, who were taking a leading and otherwise meritorious part in bringing about the repeal. We stated, p. 212, vol. II., that "although *we* advocated the repeal of the Combination Laws, it was not *in order that combination might be produced*, but *that it might be done away with entirely on the part both of masters and men*, and things left to find their natural level." We cautioned the working classes against "secretly looking forward to the repeal as a measure which would enable them to combine at pleasure, and have all their own way;" and we finally held it forth as a probable result, that "should it be the effect of the nearly accomplished repeal of the Combination Laws to strengthen old combinations and produce new ones—to encourage more than hitherto associations of workmen against their masters—to produce evil rather than good—the old laws would be restored (never again perhaps to be repealed), or new ones would be enacted, still more rigorous and severe in their operation."

It was with much regret, we witnessed the alarming extent, to which the fears we thus expressed were progressively realized, after the repeal had taken place; nor is it with any other feeling than regret, that we see our operative friends threatened with the very consequence which we anticipated. No consolation that we may honestly derive from the reflection, that we gave them due warning of the errors into which they have fallen, can equal the pleasure we should have felt had they been benefitted by it. A change was effected in the law, which, properly interpreted, was calculated to be of immense benefit to the working orders, when the old enactments against combinations were wholly erased from the Statute Book; and by misinterpreting it in the manner which we deprecated, they have furnished not only a pretext to that numerous class who, having little wisdom of their own, are ever crying up the wisdom of their ancestors, to clamour for a restoration of the old order of things, but have compelled even the wisest and most enlightened men amongst us to acknowledge, that it is become imperiously necessary to subject to revision the new state of things which the repeal in question has produced.

On the 29th of last month the subject was brought before the House of Commons by Mr. Huskisson. After apprising the House, that though a member of the Committee to whom the consideration of the Combination Laws was last Session confided, he had been prevented, by the number of his other avocations, both from paying that degree of attention to their proceedings which he could have wished to do, and from considering the Bill which was afterwards introduced on their report, with that care which it deserved, the Right Hon. Gentleman proceeded to give an analysis of the provisions of that Bill, which showed, in a very striking manner, how the working classes have been *betrayed* (as the Right Hon. Gentleman confessed, and we anticipated) into an abuse of the benefits which it was intended to confer on them.

"He was not surprised," he said, "when he looked at the way in which the Act of last Session was worded, and the artful misconstruction that might easily be put upon it *by those who best knew how to mislead and deceive the men who had engaged in these combinations*, that the men should have erroneously supposed their proceedings to be warranted under this Act. Not only did the Act repeal 'all' former statutes relative to combinations and conspiracies of workmen, but it even provided that *no proceedings* should be had on account of any such combination, meeting, conspiracy, or uniting together, of journeymen, &c. for, in fact, almost any purpose; and

thus it went to preclude the possibility of applying any legal remedy to a state of things which might become, and which had since become, a great public evil. The second section declared, 'that journeymen, workmen, and other persons, who shall hereafter enter into any combination to obtain higher rates of wages, or to regulate the mode of carrying on any manufacture, trade, or business, or the management thereof, shall *not be subject* or liable to any indictment or prosecution for a criminal conspiracy or combination, or to any other proceeding or punishment whatever, under the common or statute law.' Would not any body, on reading this sentence, suppose it was something really fit and almost commendable for workmen to combine and conspire together to regulate and control the management of any manufacture? He did not doubt that a great proportion of the associated and combined workmen in the country did, in fact, believe, that so far from violating the law by their late proceedings, they had been only pursuing a course that was strictly conformable with the meaning of the legislature. It was, moreover, provided by section 6th, 'that if any person shall hereafter, by threats, deter a man from his hiring, or engage in any combination or conspiracy to *destroy* any machinery, goods, wares, or merchandizes, he shall, upon being convicted of such offence before a Magistrate, on the evidence of any two witnesses, be punished with two months' imprisonment.'—(Hear.)—Now, it surely did not require any Act of Parliament to declare, that to deter a man by threats from his hiring, or to combine and conspire for the destruction of goods or machinery, was an offence to be made punishable in a certain way upon conviction. Such acts were already offences by the law of the land, independent of any thing like combination; and in so far, at least, the declarations and provisions of this Act were quite supererogatory. By the old law of the land, however, some of these offences would be actual felonies; others misdemeanours of the worst sort; while the Act of last Session reduced the whole to the class of the most ordinary misdemeanours, punishable, at the utmost, with only two months' imprisonment. Even plotting together for the *destruction* of machinery and merchandize, and deterring men from the exercise of their callings by threats of *loss of life and limb*, were no longer to be considered as offences of any deeper die than the commonest assault or pettiest larceny!!!"

What had been the consequence of the misconceptions which these provisions were so naturally calculated to produce on the minds of the working classes?

"Since the passing of the Act in question, there had been numerous reports forwarded to Mr. Secretary Peel, detailing acts of outrage and violence, on the part of workmen combined against employers, of the most disgraceful character.—(Hear, hear.)—His Right Honourable Friend had permitted him to inspect those reports; and he could state that they manifested, in all those classes of workmen who had misconceived the real object of the legislature in the late Act, a disposition to combine against the masters, and a tendency to proceedings destructive of the property and business of the latter, which, if left to itself, and permitted to remain unchecked, must terminate in producing the greatest mischiefs to the country. Indeed, those mischiefs were rapidly growing in some districts to so alarming a pitch, that if their progress were not speedily repressed and interrupted, they would very soon become rather a subject for his Right Honourable Friend to deal with in the exercise of his official functions, than for him (Mr. Huskisson) to call the attention of the House to in this manner. These things could not remain much longer in their present condition, unless Parliament should interfere to place them on a different footing. His Right Honourable Friend (Mr. Peel)—armed, as he was, by the state, with the authority of *calling in aid to the civil power*, for the protection of the property and liberty of the King's subjects—must so interpose against what he (Mr. Huskisson) could not but consider a very formidable conspiracy in certain bodies of men, calculated to place that liberty and property, and perhaps life itself, in the greatest jeopardy, as regarded certain individuals who employed large numbers of labourers and journeymen."

The evil consequences of such proceedings, as regarded the men themselves, were also very justly and forcibly adverted to by the Right Honourable Gentleman:—

"He did conceive, that if these misguided men could be induced, for one moment, to reflect upon what must be the inevitable consequences of the course they were pursuing, they must see that such a course of proceeding, if continued, would render it impossible for any person to embark his capital under risks so great as those which he had pointed out, or to submit its application to a system of tyranny and control that nobody with capital would for a moment choose to endure. If they would reflect on these facts, they would perceive the impossibility of their being left at liberty to pur-

sue the career of violence and combination in which they were now proceeding; and that they must soon cease altogether to procure employment for their own subsistence. For so soon as they persevered in these measures, capital must desert the districts in which they were carried on; and ultimately, unless the evil was arrested, the kingdom itself, for other countries."

For all these reasons, and with the hope of doing better justice to both parties—the workmen and their employers—Mr. Huskisson concluded by moving

"'For the appointment of a Select Committee to inquire into the effect of the Act of the 5th Geo. IV. cap. 95, in respect to the conduct of workmen and others in different parts of the United Kingdom; and to report to this House their opinion as to how far it may be necessary to repeal or amend the provisions of the said Act.'—(Hear.)"

(*Further observations in our next.*)

"SCIENTIFIC MISCELLANY."

SIR,—As you occasionally notice works that in any way tend to advance the Arts as well as disseminate useful knowledge, I beg to call the attention of your readers to a small pamphlet which has just appeared, and which contains many truths with regard to mechanical and philosophical subjects, in the form of short propositions, the investigation of which is left to the ingenuity of the reader, forming, as it were, a manual of natural philosophy, and embracing a variety of subjects, the application of which is necessary to the mechanic as well as the man of science.

The work I allude to is entitled, "The Scientific Miscellany," by W. Shires, and sold by J. T. Setchell, 23, King-street, Covent-garden, as well as at most mathematical instrument makers. In my perambulations, I was struck with the title, and induced to purchase, in the hope of finding something new or interesting, and in which, I assure you, I have not been disappointed. As the work will speak for itself, I will not intrude on your valuable columns more than by making two or three extracts, to show that this pamphlet is not devoid of interest, but worthy of being more generally known.

From the several articles (which are nearly 100 in number) I shall select as specimens the following, namely :—

Article 12.—Light always seeks the most rare medium, and therefore acts in straight lines only when cutting the surfaces of the mediums at right angles, or when passing through one and the same medium.

Art. 16.—If a liquid drops, or is spilled, whilst being carried, it will branch out in the direction in which it was carried, and hence the porter of it may be thus traced.

Art. 26.—A force given to a body diverges out in straight lines from the centre of gravity of the striking body into the body which receives it; hence the force becomes scattered in the receiving body inversely in the squares of its effect.

This effect may be best seen by striking a hard blow on clear ice, of about five inches thick.

Art. 92.—To find the power gained by a train of clock-work, &c. call the power unity, then take the continued product of the diameter of all the wheels, and divide by that of all the pinions.

I will not intrude farther on your pages, but shall leave it in the hands of those who may peruse the work to appreciate its merits, or criticise its defects, feeling I have done my duty in endeavouring to make more generally known a subject connected with the advancement of knowledge.

G. A. S.

WEIGHT OF CARRIAGES IN MOTION.

SIR,—Your indefatigable Correspondent, G. A. S., will excuse me for checking a principle he has advanced in your 83d Number. He thinks, by resolving the two forces, as represented by the sides of his right-angled triangle, into the hypothenusal line, that, owing to the oblique direction of that force, it will press less upon the weigh-bridge than the perpendicular force; but I would beg to remind him, that the oblique force being equivalent to the other two, must be greater, *in the exact direction in which it acts*, than either force singly. But since,

from the oblique position in which the resultant of the forces acts on the weigh-bridge, it must be less than if the compounded force acted perpendicular to its plane (the plane of the weigh-bridge), *and this in exact proportion to its obliquity*; it follows, then, that the oblique compounded force *exerts the same pressure upon the weigh-bridge* (AND NEITHER MORE NOR LESS THAN THE SAME) *as if the perpendicular force acted singly*. Indeed, we may assert it as a general rule, that the effects of forces, when estimated in given directions, are not altered by composition or resolution.

I am the more anxious to check this error of your Correspondent, because, from the superior talents with which that gentleman appears gifted, many of your readers would metamorphose those blemishes into the most sound orthodox principles. So true is this remark, that the celebrated Fontenelle has openly asserted, that he would undertake to persuade the whole republic of readers to believe that the sun was neither the cause of light nor heat, if he could only get six philosophers on his side. "That man, therefore," says an elegant writer of the last age, "although clothed in rags, who is capable of deceiving even indolence into wisdom, and who professes amusement while he aims at reformation, is more useful in refined society than twenty Cardinals, with all their scarlet, and tricked out in all the fopperies of scholastic finery."

I may hereafter give you my opinion on Mr. Sam. Yelsap's question; for the present I can only say that G. A. S.'s is not the only solution that can be given to it.

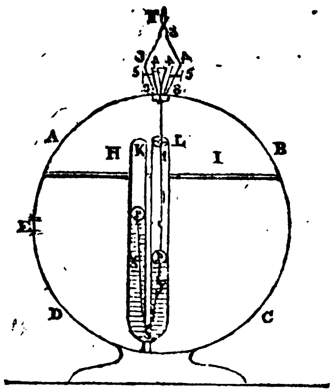
I am, Sir,

Your humble servant,

JAMES YULE.

P.S. Let these remarks apply also to your Correspondents G. G., C. E., and S. Y., whose errors I formerly pointed out to you. I do not mean to press my suit, but, in addition to that letter, I may add, that in G. G.'s trigonometrical solution of the Balance Question, *there is not a proportion existing in the terms of his analogy*; for the oblique force, being actually less than the direct force (or the man's weight), can never bear the same relation to it which the radius of a circle bears to any sine less than 90°. The thing is absurd; consequently, instead of saying that the man's weight grew less in proportion to the oblique force exerted by the hand, I would have been fairly borne out, if I had even said, *the man's weight gravitated towards the moon!!*

DESCRIPTION OF A PORTABLE GAS LAMP, INVENTED BY MR. JAMES JONES, OF EDINBURGH.



ABCD represent the lamp; E, the opening at which the gas is forced in, by means of a pump, and F the jet at which it escapes and is consumed. H, I, is a bar to support the glass tube, KSL, open only at one end. The space from K to the float P contains mercury. The two floats, P and R, are connected by the string or chain, XY; and to the top of the float, R, the stout wire, II, is attached perpendicularly. To the top of this wire is affixed a cubical piece of metal, shaped on all sides like a wedge. This is contained in a kind of box, marked 3333, which is also shaped wedge-like, but with a greater angle at the bottom; 44 are two metal plates, each exactly the same size as one side of the box. These plates are to be pushed backwards or forwards by the screws 55, till the aperture is adjusted, when the ends of the screws may be cut off.

Now, suppose the cubical vessel, ABCD, empty of gas, the mercury in the tube is alike high at both surfaces.

The forcing pump is applied at E; and as the gas is condensed, it compresses the air in the end of the tube at K: of course the mercury rises, carrying the float, P, up along with it; the other ball is drawn down, and brings down with it the wire, Z, which gradually stops the opening at the top of the wire; and as the gas contained is diminished, the pressure will be taken off the surface of the mercury at R, the air at K will expand, and raise the wire, Z, and enlarge the opening.

PROPOSAL FOR USING SPIRAL WHEELS IN STEAM NAVIGATION.

Sir,—The imperfections of Paddle-Wheels for propelling steam-vessels are generally known, and have given rise to various contrivances for obviating them, for some of which patents have been obtained. These contrivances, it should seem, have not been very successful, as paddle-wheels appear to be universally in use; it is, therefore, desirable that this subject should have the continued attention of mechanics, as their enlightened diligence cannot fail to have very beneficial results; and it is for the purpose of communicating an idea, which I conceive may contribute to produce an improved method of propelling such vessels, that I now address you.

The most obvious imperfections of paddle-wheels are, first, the great loss of power occasioned by the oblique pressure of the paddles on the water when they first enter it; and which, though gradually diminishing, is not wholly lost till the paddle becomes vertical. This oblique pressure may be resolved into two forces, the one vertical, the reaction to which raises the vessel, and the other horizontal, which propels it forward, and it is obvious that the whole power of the engine is excited in the latter direction only at the moment when the paddle is vertical; after this the vertical pressure begins in the opposite direction, and contributes to press the vessel into the water, and thus counteracts the little advantage that the first might produce, by lessening the draught.

And, secondly, the unequal depth to which the paddles are frequently immersed when either the water is much agitated, or the wind acts forcibly on one side of the vessel: the consequence of this is, that one of the wheels suffers the impediment last mentioned in a greater degree, and is turned with a greater loss of power; whilst the other has not sufficient hold of the water to produce its maximum of effect.

The mode of propelling steam-vessels to which I would call the attention of your intelligent Correspondents, particularly those engaged in constructing or navigating them, is to substitute for paddle-wheels a worm-like spiral wheel (if it may be so called), that shall work in the water in the manner of a screw, to be formed by a flat board or ledge wound spirally round an axle, just like the screw of Archimedes, without its external rim: one of these on each side of the vessel, placed with their axles longitudinally, at any depth that may be found convenient, but somewhat below the water's surface, would produce a progressive motion, accompanied by very little collateral resistance, with a very gentle agitation of the water, and with very small loss of power.

The pressure of these spiral wheels upon the water being an oblique one, which may be resolved into two forces, one of which acts in the direction of the axle, and the other perpendicular to it, it is obvious that this latter force would soon drive the vessel against one of the banks in rivers, and athwart the keel in the open sea, were they both to work the same way; but by making them turn in different directions, the lateral force of each would be counteracted by the other: but whether it would be better to drive the water in a direction diverging from the sides of the vessel, or converging towards its rudder, will be best determined by practice.

The objection which I foresee to this machinery is, first and principally, the room which it would occupy on the sides of the vessel under the surface of the water, being equal to the diameter of the spiral, the radius of which would probably be not less than eighteen or twenty inches;

more or less, according to the size of the vessel, thus filling a space of perhaps three feet and a half on each side; and though, by being placed lower, it probably would not increase the width of the vessel more than paddle-wheels now do, yet that circumstance would render it inconvenient in difficult navigations, and may much restrict its use in rivers and canals, though I do not apprehend that this will be a material objection to vessels navigating on the sea.

A second objection may be founded on the velocity of the rotatory motion required to produce a given progressive motion. It is easily perceived, that the progressive motion acquired in one revolution of the spiral wheel cannot exceed the distance of its threads from each other, but must indeed be somewhat less, owing to the yielding nature of the water; whilst that obtained by one revolution of a paddle-wheel bears a great proportion to its circumference: but this objection, I think, will be overbalanced by the diminished force required to turn the spiral wheel, and the small proportion of it that will be inefficient.

I will not trouble you with any farther observations, my object being to draw the attention of your Correspondents to this subject, for the purpose of ascertaining its practicability. If you think the suggestion worth publicity, a page of your very useful Magazine will oblige,

Yours, &c.

——, near Boston. T. M.—S.

INQUIRIES.

No. 112.—POWER OF STEAM ENGINES.

Sir,—Seeing in your valuable Journal several methods of calculating the Power of Steam Engines, but that not any of them pay any respect to the length of the stroke, I should feel obliged if some of your ingenious Correspondents will inform me, what effect the shortening of the stroke has upon the power of the engine; or, in other words, what increase in the diameter of the cylinder will compensate a decrease in the stroke? For instance, a cylinder of 24 inches diameter, with a stroke of five feet, equals about 20 horse power; what diameter of cylinder is required if the stroke is only three feet?

Blackfriars-road. X.

No. 113.—COMPARATIVE COST OF STEAM ENGINES.

Sir,—I should be thankful to any of your Correspondents who could give a table of the comparative expense of the Purchase of Steam Engines of various construction, and say of 15 horse power; and also of the expense of working the same—say for one week, night and day, without intermission. In the latter, of course, I allude to the cost of coals, oil, or any other combustible substance or fluid that may be requisite; as also to the wear of machinery and hire of labourers.

I am, Sir,

An Old Correspondent,

17th March, 1825. Xx.

ANSWERS TO INQUIRIES.

No. 110.—ELECTRIFYING MACHINES.

Sir,—Your Correspondent, "Junior," may make his caps of wood or brass. I have turned one pair out of box-wood. The cement for fixing them on the necks of the cylinder, is made by melting equal parts of rosin and bees-wax, and one-fourth of their weight of red ochre. It will be necessary to drill a small hole (longitudinally) through the cap that is first fixed (which may be done while the cap is yet in the chuck), to suffer the air in the cylinder to escape, which the heat of the cement will cause to be rarefied, on fixing the second cap, otherwise the cylinder will be in danger of being burst to pieces. The rubber consists of a cushion, stuffed evenly with curled

hair, a little concave on the face, that it may lay flat against the cylinder; the outside to be made of wood, with the roughnesses taken off. The side next the cylinder is covered with red basil, and to the lower edge of the cushion is glued a piece of silk, called black mode, of the breadth of the cushion, and is brought up between the cushion and the cylinder, and lies about half over the latter. But the cylinders made at the glass-manufactories are generally irregular on their surfaces, and of unequal diameters, and consequently do not receive a constant and steady pressure; but by means of a plain bent metallic spring (invented by Mr. Jones, the optician, in Holborn), acting between two narrow boards, to which the stuffed cushion is glued, a steady pressure is obtained, and the spring will readily yield to the irregularities on the surface of the cylinder.

I am, Sir, yours respectfully,

Wm. Pickett.

Brook-street, Ratcliff.

NO. 89.—CHESS-MEN.

Sir,—I beg leave to send Inquisitor a Composition to make his Chess-Men of: I must state, at the same time, that I have not made a trial of it, though I think it will answer the purpose.

Take fine saw-dust of lime-tree wood, put it into a clean pan; tie it close up with paper; dry it by a gentle heat; beat it in a stone mortar to a very fine powder. Take one pound of fine parchment glue, the finest gum tragacanth, and gum Arabic, of each four ounces; boil the whole in clean pump-water, and filter it; add as much of the wood as will make it a thick paste; set it, in a glazed pan, in hot sand, till the moisture evaporates, and it is fit for casting. Pour or mix your colours with the paste; scent with oil of cloves or roses, &c. The moulds should be made of pewter, and well oiled; when dry, it will be as hard as ivory; it may be turned, carved, or planed, like other wood.

Knaresborough. M.

NO. 80.—NEW IMPERIAL MEASURE.

Sir,—I send you, in answer to T. H.'s proposition (Number 80, p. 382), the following inside dimensions of the Quart, Pint, and Half-pint; also the thickness of metal of the top and bottom, and thickness of the bottoms, all in inches. I must beg leave to observe, that T. H. says, "the top diameter and perpendicular depth of each to be equal to the bottom diameter in proportion to the top as 7 to 10;" whereas, I presume, he means the top diameter and perpendicular depth of each to be equal, and the bottom diameter in proportion to the top as 7 to 10.

Your constant Reader,

B. C.

	TopDiam. & Depth.	Bottom Diameter.	Thickness of Metal: Top.	Thickness of Metal: Bottom.	Thickness of Bottoms.	Content.
Quart...	4.94477	3.46134	0.64262	0.44984	1.28525	69.3185
Pint.....	3.92466	2.74726	0.51005	0.35704	1.02011	34.65925
Half-pint	3.11500	2.18050	0.40483	0.28338	0.80966	17.329625

CORRESPONDENCE.

We long to hear from T. R. L.

J. A. Whitfield will please transmit the plan he has in contemplation.

Communications received from—Double Escapement—Mr. Monnom—G. W.—A. B.—W. H. S——e—B. H.—C. G.—Mr. Hall—A Resident at Lee—Islington—Phaeton—A Child—H. A. D.—A. M. F. P.—Mr. Lake—Trebor Valentine—A Foremastman—P. Q.—T. B. Mason—Lux—M. R.

Mr. Speer's letter came too late to have a place in our present Number. It shall appear in our next.

Two or three other papers intended for insertion this week, are unavoidably deferred.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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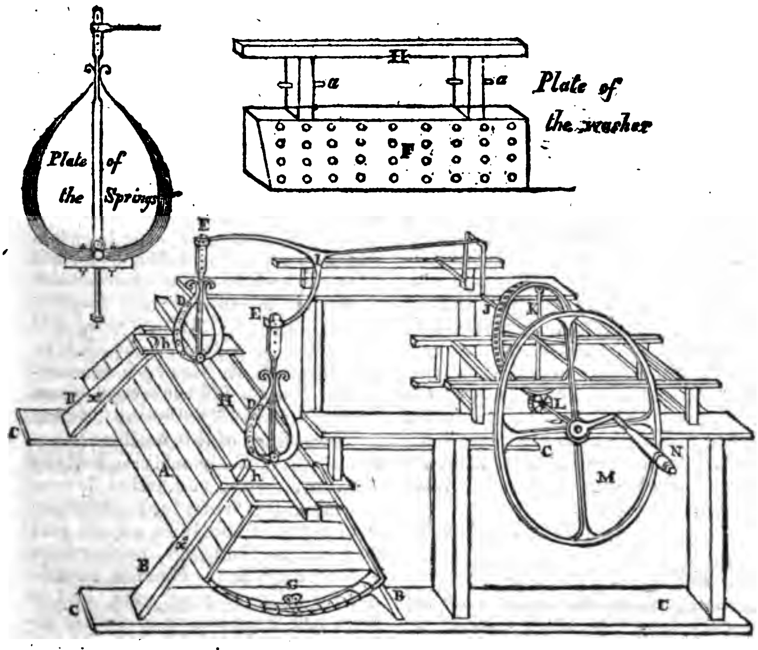
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 86.] SATURDAY, APRIL 16, 1825. [Price 3d.

"Science clears the obstructions which impede the progress of Art, and Art adorns and smooths the path of Science. No discovery is made without some previous conjectural effort of the mind, some exertion of the imagination; nor is any beauty unfolded where there has not been some preconsideration of probable effects, some exertion of the reasonable faculties."—*Ferro.*

WASHING MACHINE.



SIR,—The drawing and description, &c. of a Washing Machine, which I take the liberty of transmitting herewith, I shall be glad to see inserted in the Mechanics' Magazine.

I am, Sir,
Yours respectfully,
J. ARMSTRONG.

Northumberland House Academy, Norwood.

Description.

A is the washing-trough, supported upon four legs, BBBB, by two iron straps, screwed through the legs, by the nuts, *x x*; the legs are let into the frame, CCCC; at the end of the trough is a cock, G, to carry off the soap suds; in the trough is a washer similar to F, perforated with holes, and borne by the beam, H, upon the cross bars, *h h*, by the spindles, *a a*. Upon the beam, H, are two iron pillars, EE, with a joint

near the beam, H; on each side of the iron pillars are strong springs, DD, of four or five leaves, set very proud at the top against the iron pillars, and bolted together at the bottom upon a stout piece of iron. The tops of the iron pillars are attached by a bolt to the beam, I, of the crank, J;* and upon the axle-tree of the crank is a tooth-wheel, K, turned by a small pinion, L, upon the axle-tree of the fly-wheel, M, which is turned by the handle, N.

If a machine upon this plan be made with a trough three feet long, and the pinion, L, to revolve three times for the wheel K's once, it will first fourteen or sixteen gentlemen's shirts in fifteen minutes, and second them in five minutes, making in all but twenty minutes, and the machine may be turned by a boy of ten or eleven years of age, as it would require no more strength than one of Mr. Baker's patent mangles.

The inventor of this machine does not assert that the whole is original; a trough and washer similar to this he saw when a boy at school, but all the rest is original. He has made two machines upon this principle, the second having some improvements upon the first, and they both answer well when properly managed. This machine would be found most valuable where there is much washing; it is simple, and easily managed when there is a will that it should answer the purpose; but if the use of it be left to careless servants, or washerwomen, the machine, in such cases, will have to bear the blame of bad washing;† whereas, when used with even moderate skill, it will wash more linen in six hours than six women can wash in twelve hours.

Directions for Use.

Soap your linen in warm water the day before washing (this mode at all times materially assists the cleansing of foul linen); dissolve about two-thirds of the soap (deemed necessary for cleansing your linen) in hot water, the night before you wash, to be ready for use. When you put your linen into the machine, be sure to put, as nearly as possible, the same quantity on each side of the washer, and let it be laid regularly along the trough, of the same thickness or quantity; for, if linen be laid thick in one place and thin in another, the thick part will be cleansed, and the thin but little.

Ladies' dresses, laces, caps, and any thing delicately fine, should be put into a porous linen bag, or a fine meshed net (indeed, if all small things were put into a small meshed net, so much the better, as it would prevent them being entangled by being washed over the top of the washer), then no accident can happen to the linen.

When you have put your linen into the machine, pour upon it as much of the dissolved soap as may be deemed necessary to cleanse the quantity of linen in the machine; then pour in the water or soap suds, boiling hot, and after you have fixed your cover on the trough, turn the machine for one quarter of an hour, and your linen will be cleansed, unless it is very foul indeed, in which case a little more time must be allowed; then take the linen out, and at the same time draw off the soap suds, and charge your machine as before. Whilst the machine is washing the second charge, get your cleansed linen wrung and the soap suds boiled, ready for the third charge; and when you have gone through the firsting of all your linen in this manner, commence and pursue your seconding in the same manner, allowing about five minutes for each machine full. Be sure never to put any dry foul linen into the machine, as the boiling liquor will fix the dirt, which will never afterwards be wholly eradicated: this is a very common error in cleansing linen, where machines or washing-dollies are used.

One of these machines may be seen by applying at Mr. W. Richards's, measure-maker, No. 16, William's-court, Great Guildford-street, Southwark, London.

The savings of this machine are—two-thirds of the usual time, half the usual fire, soap, and, what is very desirable, the linen; for the machine does not wear the linen a tenth part so much as the hands, neither does it tear the linen. One has been in use for eight or nine years, and it has never been known to tear or injure any thing, although it has cleansed the most delicate parts of dress.

This machine may easily be made to wash in any pressure of steam; and if constructed for that intent, it would (in the humble opinion of the inventor) far surpass any steam-washing machine yet made; for without pressure linen cannot be cleansed in any moderate time, and cylindrical wheels, revolving in a case, may,

* If several holes are made in the iron pillars, the pressure may be increased or decreased at pleasure.

† The inventor asserts this from real experience.

by the linen constantly falling from the centre, chafe the cloth nearly, if not quite as much as the hands. One proof that this machine does not wear the linen is this: if you put in stockings with holes in them, the holes will not be in the least enlarged by the machine, nor will it make holes in thin places; where linen, on the contrary, is cleansed by chafing, and not pressure, enlargement of the holes in stockings, and holes made in thin places, are sure consequences; this is a fact known to every domestic female.

Should any person or persons wish for any farther information, with respect to the mechanical construction of this machine, either to wash in a pressure of steam, or otherwise, it will be cheerfully given, on addressing a line to J. Armstrong, Northumberland House Academy, Norwood, Surrey.

ADVICE TO STAMMERERS.

It has been observed, in regard to stammerers, or those who have a defective utterance, that they can sing, or even read, without hesitation, although they cannot speak. What is the rationale of this fact? It will be found to depend on the following principle:—

Continuous muscular action is far more easily effected than that which is interrupted. This principle is even general in physiology. It has been remarked, that a drunken man, or a person affected with that disorder termed St. Vitus's dance, can run, though he cannot walk, or stand still. In the same manner, a stammerer can sing, which is continuous motion, although he cannot speak, which is interrupted.

Continued muscular motion is also attended with less fatigue than that which is interrupted; and this is particularly observed in regard to speech. It is on this account that there is a tendency, in those who speak much in public, to acquire a sort of sing-song mode of delivery, which it requires good taste and constant exertion to correct. It is on this account, too, that those who cry in the streets, actually acquire a sort of tune, or cry, as it is termed; the continued action of the muscles of speech being so much more easy than the interrupted. The same is constantly observed in children on their first attempts to read. Let a stammerer, then, observe this rule:—Always to speak in a continued or flowing manner, avoiding carefully all positive interruption in his speech; and if he cannot effect his purpose in this manner, let him even half sing what he says, until he shall, by long habit and effort, have overcome his impediment; then let him gradually, as he may be able, resume the more usual mode of speaking, by interrupted enunciation. It is understood that this is the principal means employed by those gentlemen who have undertaken to correct impediments in the speech, and it is undoubtedly the most rational. In addition to this rule, let the stammerer endeavour to speak in as calm and soft a tone as possible; for in this way the muscles of speech will be called least forcibly into action, and that action will be least liable to those violent checks or interruptions in which stammering appears to consist.

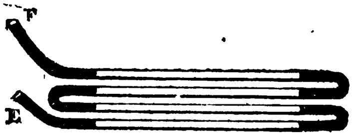
It is scarcely necessary to remark that there are other inducing causes of stammering, such as nervousness, which must be cured by different means. Of these it would be necessary to treat in an essay written expressly on this interesting subject.

BROWN'S GAS VACUUM ENGINE.

We are informed that Mr. Brown has tried his engine with *a piston*, and that it is found to answer his most sanguine expectations.

A Company, we perceive, has been formed for applying this engine to the purposes of boat and barge navigation. They have begun by offering a premium of one hundred guineas for the best model, exemplifying the power when applied to the head, stern, or sides of a vessel, both in shallow and deep water, in canals and rivers. A premium of thirty guineas is also to be given for the second best, and twenty for the third best models.

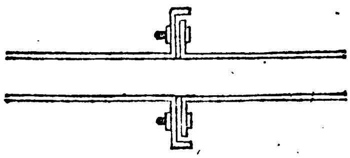
TO BOIL WATER IN WOODEN VESSELS.



Sir,—I send you a drawing of an apparatus for boiling water in a wooden vessel, which I erected for a gentleman in a country where fuel is scarce and dear. It answered all the purposes desired, and is attended with both economy and cleanliness. The figure represents four old musket barrels (the breech-screws being out, and the touch-holes plugged), connected together by a leaden pipe, as in the dark part of the drawing. These constitute the bottom of the fire-place, or might be converted to form the front bars of the grate, or made to serve both purposes. They are to be set in stone or brick, so as to keep the lead from the action of the fire, and at a proper height from the ground to leave space for an ash-hole. A leaden pipe is to be joined to each end, EF, and the two are to be inserted in a wooden vessel containing water, the lid of which is to be steam-tight. Care must be taken that the pipes do not enter the water-vessel at equal heights; one should be near the top, and the other the bottom of the water, by which arrangement the heavier cold water enters the lower orifice, E, fills the pipes under the fire, and issues, in an attenuated boiling state, into the water-vessel through the upper orifice, F. The barrel or water-vessel may be in an adjoining room, out of sight, and the water heated by the parlour fire, without any inconvenience. This mode of heating water is peculiarly adapted for families and invalids who are in the habit of using the warm bath, which is by these means always at hand, and ready, in case of emergency, all hours of the day and night. It is surprising the little fuel necessary to keep the water hot, after it has been heated. In the morning it was painful to the hand, and kept so by only the wood embers and ashes with which the barrels were surrounded all night. The expense is trifling: for washing, the saving of fuel is considerable; and the *wear and tear* is almost nothing; neither is there any danger to be apprehended from the apparatus. I strongly recommend it to private families, and will show in my next how to steam-wash clothes by means of it.

I am, Sir,
Very respectfully yours, &c.
Haspy Smolet.

IMPROVEMENT IN STEAM-PIPE JOINTS.



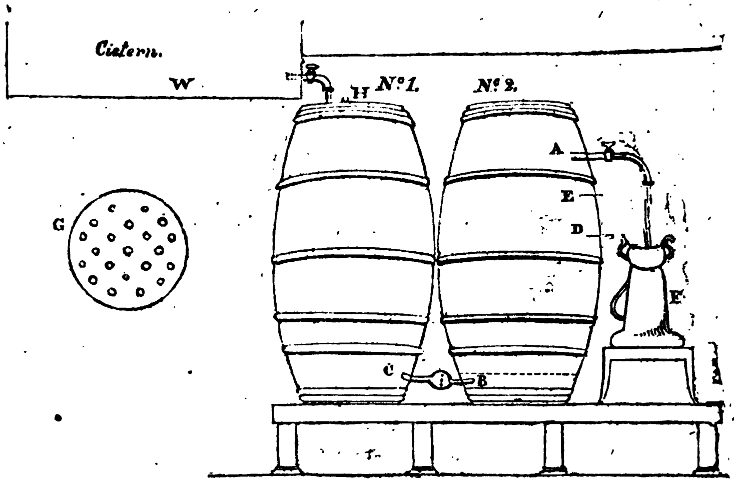
Sir,—The above is what I consider an improvement in the Joints of Steam Pipes, which I believe to be new, never having seen it in use. It consists of having the flanch of one of the pipes made with a rim about half an inch broad, and an inch thick, and the flanch of the other pipe made to fit within this rim, as in the engraving. Now, the advantages of this improvement are, that the gaskins cannot slip out of their place while the pipes are being screwed together; and that after they are screwed home, the seam round the rim can be caulked with hemp and white lead, which will render leakage impossible.

Should you think this worthy a corner in your valuable miscellany, your insertion of it will much oblige,

Yours truly,
R. Farley.

Rotherhithe, March 15, 1825.

IMPROVED FILTERING APPARATUS.



Sir,—Having come from Yorkshire to spend this season of festivity among my friends in town, I have been somewhat surprised to find, that where I expected to observe every thing depending on the skill of man in a state of the highest perfection, many things which seem to call for but little of that skill, and are yet objects of the first necessity, are no better than elsewhere—nay, not half so good. I would particularly instance the exceeding impurity of the water with which the knowing folks of the metropolis are in general supplied. I have nearly gone the round of my town cousins, and, strange to say, have not been able to obtain from one of them a glass of water fit to drink. Need I descant, Sir, on the importance to the health of having this indispensable article of life of as salubrious a quality as possible, or on the many diseases and infirmities which must be engendered, where it contains, as in London, such an abundant admixture of mud, insects, and other impurities? I should suppose, Sir, that it could be no difficult matter to remedy this grievance, especially now-a-days, that men of science and philosophy are condescending to bestir themselves a little about the affairs of ordinary life; and to you, as one somewhat distinguished in this way, I take the liberty to address myself on the subject, in the hope that you will either yourself point out, or, by submitting the matter to your numerous scientific readers, induce some of them to show how the good people of London may cease from drinking such aqueous abominations, and be able (when next he visits them) to give a glass of pure water to

A Yorkshire Grazier.

December 28th, 1824.

The impurity to which our Correspondent directs our attention, is undoubtedly one of very serious moment, and felt (we believe) very generally throughout the metropolis. In the district where we reside (Christ Church, Surrey), it is a subject of as much complaint, perhaps, as any where. The water, as supplied from the (Lambeth) water-works is so grossly impure, that (in the absence of filtering) it can only be safely used in food or drink after it has been boiled, recooled, and allowed to settle for some time—a process which is not only attended with considerable trouble, but which necessarily deteriorates the quality of the water. A

Correspondent (Mr. James Lewis) in our 21st Number (p. 325, vol. I.), and who resides in the same neighbourhood, having described a filtering apparatus (made with two flower-pots), by which he had succeeded in obtaining water "beautifully clear," a friend was induced to make a trial of one of that description, and found that, in all but the inconsiderable quantity which it was calculated to supply, it answered well.

The following is a description of a somewhat similar method of filtering, which we have ourselves adopted. We procured a cask, somewhat less than a porter hogshead, but of a different shape, in order to give the better effect to the filtering process, being 40 inches deep on end, and 20 inches in diameter at the top and bottom. We then had a second or false bottom made, and perforated by a three-quarter inch gouge with about 18 holes; this we grooved into the cask about four inches above the undermost or real bottom, and covered it over with four plies of coarse flannel. Our next business was to procure a quantity of coarse *fresh water sand* (for in a trial which our friend made with the flower-pots, he found that small or sea sand would not answer the purpose), and with this we filled the cask to the height of 20 inches from the false bottom, beating it hard down as it was put in. Above the sand we inserted another false bottom, perforated like the former, but not grooved into the cask; and over that again, two plies of flannel. We then added layers of sand and pounded charcoal alternately, for the height of ten inches more, and above these placed a lid, perforated and covered with flannel, like the two false bottoms. The six inches of the cask which were now left unoccupied, we appropriated to the water to be filtered; a space equal to the reception of from eight to ten gallons. On making an experiment with the filter we had thus constructed, we found that the water, however impure when first put in, came out as clear and sparkling as crystal; and finding, on a continued trial, that we can procure in this way more than twenty gallons of such water every twelve hours, we rested at first well satisfied with the degree of benefit we had realized.

On farther reflection, however, we are convinced that the water might be produced of even greater purity, were it made to percolate *upwards* instead of *downwards* (as partly suggested by our Correspondent, Mr. Lewis); we intend, therefore, to have our apparatus altered to one of the improved description represented in the prefixed sketch.

Description.

No. 1 is a cask, 40 inches deep by 20 in diameter, to be filled with water from a cistern, W.

No. 2, another cask of the same capacity, to contain the filter.

B, the first false bottom, perforated and covered with flannel.

D, the height to which the cask (No. 2) should be filled with sand, and at which the second false bottom should be inserted.

E, the lid, between which and D equal quantities of sand and charcoal are to be interposed.

C, communicating cock between the two barrels.

A, a cock to discharge the pure filtered water.

F, a vessel to receive the water.

G, the false bottom, to be grooved into the cask, No. 2.

H, a ball-cock, to regulate the filling of the cask, No. 1.

An apparatus of the kind we have described, must obviously have great advantages over any filter than can be made of stone. By removing the upper lid, E, whatever refuse may gather on the top can be skimmed off occasionally. New layers of sand, and charcoal too, can be introduced with great ease, so that the apparatus can, with very little trouble, be kept at all times in tolerably efficient action, and may, at a little expense, be renovated entirely, whenever that is found necessary. All the stone filters, on the contrary, that we have ever seen, get rapidly clogged with the earthy deposits from the water, and if not frequently cleaned out, soon cease running altogether.

It is deserving of remark, that when the water is suffered to stand in

the filter for any considerable time, it is apt to acquire a rank taste. It should be drawn off regularly at short intervals, or, what is better, kept constantly running.

SIR WILLIAM CONGREVE'S MOVEABLE BALL-CLOCK.

The *cognoscenti* in elegant mechanism have long been in the habit of admiring a beautiful timepiece, which bears Sir William Congreve's name, in which the minutes are indicated by the descent of a brass ball along a number of inclined planes, running alternately from right to left, and left to right, on the face of an inclined brass plate. When the ball reaches the bottom of the plate, after having described the last of the inclined planes, it releases a detent, which tilts the brass plate, and inclines it in the opposite direction. The ball being now at the top of the system of inclined planes, commences its retrograde motion, and when it again reaches the bottom, the plate is again tilted at the opposite position.

This clock was invented (as Dr. Brewster states, in his last Quarterly Journal of Science) by M. Serviere, and is minutely described, in various forms, in a French work entitled, "*Recueil d'Ouvrages Curieux, &c. Lyons*, 1719." In all those clocks, however, the ball is carried up, by machinery, from the bottom to the top of the inclined plane, whereas, in Sir William Congreve's, the plane is moveable, as above described, which is a very important improvement.

PLANS FOR SAVING LIVES FROM SHIPWRECK.

SIR,—Seeing the description of Mr. Bell's Invention for saving Lives from Shipwreck, published in the 68th Number of the Mechanics' Magazine, and knowing how necessary it is that some general plan should be adopted for giving this valuable invention its full effect, I am induced to request your insertion of the following scheme, adapted to the mortar plan, for the purpose of bringing the crews of stranded vessels on shore, after the rope of communication has been thrown over the wreck.

The rope thrown from the mortar should not be less than two-inch, which one of Bell's mortars, having its chamber bored to contain twenty ounces of powder, would throw from 250 to 300 yards. The moment this is received on board, the crew should reeve the end through a tail-block, and haul off as much as will be sufficient for the end and bight to go on shore again, in which they may be guided by a seizing or stop, seized on by the people on shore for that purpose; when this stop reaches the block, the end is to be secured to it, and both parts being hauled on shore, a single whip-purchase will be formed, by which the people on shore may haul off whatever the situation of the wreck may render most advisable for bringing the crew on shore.*

If time and the circumstances of the case will admit, the end of a three and a half or four inch hawser should next be hauled off: this the crew must secure just above the tail-block, which should be either at the mast-head, bowsprit-end, or most elevated part of the hull, as the master may deem most advisable, in which he will be guided by the state of the mast, bowsprit, &c. always remembering that the higher it can be placed, under the lower mast-heads, with safety, the better. This hawser is to be rove through a single block, strapped, with two grommets under it, just long enough for a man to sit in each, holding on below the block. When the end of the hawser is fast on board, this block is to be hauled off by one part of the whip,

* Various machines have been invented for the purpose of bringing people on shore from stranded vessels, some of which it is my intention to describe in a future communication to your valuable Magazine, which I hope will be the means of making them known in every sea-port of the empire, and stimulate others to improve upon them.

and two men may get into the grommets, and be hauled on shore by the other part; the block, &c. being thus hauled to and fro, as often as it may be necessary to bring the whole crew on shore. At all stations having a flat beach, a strong triangle should accompany the apparatus, for the purpose of raising the hawser on shore, with a snatch-block for it to traverse in; and the in-shore end of the hawser, being previously rove through the ring of a small anchor, must be kept in hand, so as to ease it occasionally to the motion of the vessel, and to keep the crew as much out of the water as possible in their passage from the wreck.

The above plan is represented by the following figure.

Description.

A represents the mast-head, or any part to which the hawser, &c. are screwed.

B, the tail-block, through which the whip or hauling-line is rove.

C C, the two parts of the whip.

D, the hawser.

E, the block and grommets, or traveller.

F, the triangle, with snatch-block.

G, the anchor, through the ring of which the hawser is rove.

This plan is not given as original, nor is it merely theoretical; it has been partially practised with success under some of the most trying circumstances of shipwreck; and a descriptive plate, very similar, though not adapted to the mortar, may be seen in the Naval Chronicle for January, 1800.

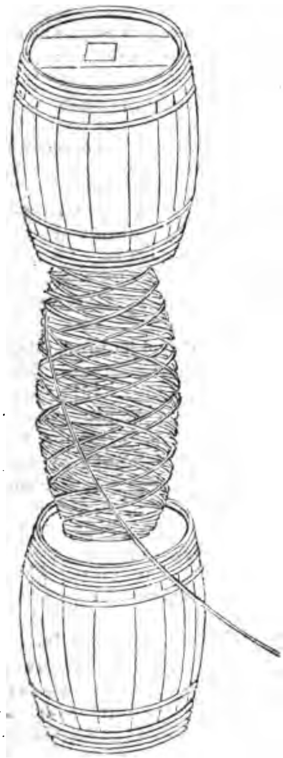
The following simple plan was lately invented by a Naval Officer, for the purpose of gaining a communication *from the wreck* to the shore, where it may be impracticable *from the shore* to the wreck.*

Let two small casks be connected by a spar going through one head of each, having its ends secured to the inner centres of the other heads, and leaving a distance between the casks of rather more than the length of one of them. The spar will then represent an axle, and the casks two wheels firmly fixed to it, and made water-tight. Upon this axle a line is to be reeled, in the manner of a log-line, and when thrown overboard, with one end of the line fast to the ship, the power of the wind and sea will keep the casks in continual revolution, until the buoy reaches the shore; and it will be found that, as the line unreels only as the casks revolve, there will be little danger of the bight getting far into the underdraught. This might be entirely prevented by making the line buoyant.†

* Rockets have been recommended to be supplied to ships, for the purpose of carrying a line on shore, and I have no doubt they would, in many cases, have the desired effect.

† In the 32nd volume of the Transactions of the Society of Arts, is an account of Mr. Cleghorn's invention of a buoyant line; and a life-buoy, or boat, invented by Mr. T. Boyce.

THE BUOY, WITH THE LINE REELED.



A Buoy of this description might be constantly kept slung over the stern or quarter of any vessel at sea, ready for cutting away at a moment's warning, either for the purpose of saving the crew from a wreck, or as a life-buoy, in case of a man falling overboard; and in the event of a ship being stranded on a bar or bank, at a distance from land, where boats cannot get alongside the wreck, this buoy being cut away, would carry a line from the ship to a boat, by which means a communication would be formed, which might ensure the safety of the crew.

I am, Sir,
Your obedient servant,
NAVARCHUS.

January 21st, 1825.

ECONOMY IN FIRE WOOD.

The size into which wood should be split, so as to be durable in burning, and yet give sufficient heat, is a matter worthy of some consideration. If split very small, any given quantity will give more heat for a while, but will be quickly consumed; if large, it will consume slowly, but will burn less readily, and give much less heat. A fire composed of billets of wood not more than fourteen inches long, will give more than two-thirds as much heat as that made of wood double that length. Perhaps billets of from three to four inches, of a medium diameter, will be found the most economical, as avoiding the two extremes.

MR. SPEER'S CONCENTRIC CHUCK.

SIR,—I am sorry to encumber the pages of your very useful publication with any thing like controversy, on so trifling a subject as the Concentric Chuck of my invention, which you thought proper to publish in your Number of March 26th; but I cannot remain silent under so gross an imputation, as that of having defrauded the Society of Arts (of which I am a member) of a reward, for what your anonymous Correspondent of last Saturday is pleased to state is "as common as chairs in a barber's shop."

That I invented the chuck for my own use as an amateur turner, without the remotest idea derived from any but the brass chucks in common use, I can most positively aver. The castings which I had made for one in metal, were manufactured by Bonsall, Marsh, and Guy, in March, 1821 (at that time in Mary-la-bonne-street, Piccadilly), as I can show by a bill in my possession; and subsequent experience of its utility induced me to lay it before the Society of Arts, where its merits as an invention were discussed before two Committees, previous to my obtaining the medal with which the Society were pleased to honour me. Both these Committees were attended by

many scientific and practical men, both engine, tool, and lathe makers, and persons professionally acquainted with turning in all its branches. Both our Chairmen of Mechanics were present, one of whom, you cannot but know, is an engineer of the first eminence, and who, I suppose, your sapient and veracious Correspondent will allow is not "very ignorant of the tools used in an engineer's workshop." The claim to novelty was particularly discussed, and the evidence of several practical men taken as to that point, as appears by the minutes of the Committee.

I have also, both before and since I submitted this chuck to the consideration of the Society of Arts, shown it to several lathe-makers and turners, all of whom have declared that they never saw any on a similar principle before.

I am, Sir,
Your obedient servant,
E. Speer.

7, New Inn, April 5th, 1825.

MECHANICS' INSTITUTION AT CRAYFORD.

To the Editor of the Mechanics' Magazine.

Sir,—As the friend of operative mechanics and artisans, you will be gratified by the information, that a Mechanics' Institution has been established in the little manufacturing village of Crayford, in Kent; and that Dr. Olinthus Gregory has very politely offered his services to the Institution.

The Doctor gave his first Lecture on Mechanics in the National School Room, on Friday evening last, to a very respectable audience of ladies, gentlemen, and operative mechanics, who evinced the interest they took in the lecture and the good of the Institution, by the profoundest silence and attention during the lecture, and by an unanimous vote of thanks to Dr. Gregory at its conclusion.

The members of the Crayford Mechanics' Institution pay twopence a-week each. The Institution is governed by a Committee, chosen by the operative mechanics in general meeting assembled, and *consists of operatives only.* A reference and circulating library is forming; and, as soon as our funds will admit, apparatus will be purchased, to enable the members to become their own lecturers. The members meet every Wednesday evening. Visitors pay sixpence each, and sons and apprentices of members will be permitted to attend gratuitously.

Such is the brief outline of our infant Institution; the establishment of which we owe to the exertions of the Rev. Thomas White, Dr. Gregory, John Fassett Burnett, Esq., and other principal inhabitants of Crayford.

By giving this communication an early place in the Mechanics' Magazine, you may induce other manufacturing villages to follow our example, and will confer an especial favour on your constant reader, and a warm friend to the general diffusion of scientific knowledge,

William Walker.

Crayford, March 29th, 1825.

MR. COBBETT'S STOVE.

Sir,—W. T. appears to be rather angry that Mr. Cobbett's Fire-place should be disapproved by any one, and pettishly states his belief, that "if he (Mr. C.) was to do the most unobjectionable and meritorious thing imaginable, there would be found some to doubt his good motives, and others to misrepresent them."

Now, Sir, without at all disputing Mr. Cobbett's good motives, I must observe, that W.T. can know but little of the world, if he is not fully sensible that public characters place themselves in that situation, that their writings and assertions are descanted upon and discussed more than other men, and this is naturally and fairly the case; for what should prevent me, or you, or any one else, who differ in opinion from this great Leviathan in the political world, from stating such dissent from him, together with the reasons for it? Mr. C. is, or has been, a great champion for freedom of discussion and the liberty of the

press; but his advocate, W. T., one may almost be led to suspect, is hostile to these liberal sentiments.

In respect to the illiberality with which I am indirectly charged by W. T., I must observe, that having read Mr. C.'s overdrawn statements of the many excellent qualities of this stove, I was induced to inspect it, and must own that I was greatly disappointed, on being shown so filthy, clumsy an article, as the highly-praised American stove in question. Now, as respects myself, or such persons who have an opportunity to see and judge for themselves, the consequence is but trifling; but to such of your readers who live at a distance in the country, and who have no other means of forming an opinion, except what may be gathered from the Political Register, the case is very different, and it was principally to guard these from disappointment, by trusting to such statements, that the article in your 80th Number was intended; and I have to remark, that W. T.'s assertion that Mr. Cobbett has given his readers and the public an engraved representation of the stove represented by him, is not correct. It is true, that an engraving has been given in one of Mr. C.'s subsequent numbers, but it appears that this engraving was furnished by the person who makes the stove, and is very unlike that recommended by Mr. C.; in fact, he disowns it. It is so altered (like Peter's coat in the Tale of a Tub), that it is quite different from the original. "The enclosed body," says Mr. C. (I have not his Register at hand to refer to his exact words, but I "know that I am right in substance), "is not mine; neither the ornament nor the burning martyrs," as he terms the figures—"I want none of them; two bricks being all that I use to keep the fire together." An elegant mode truly, and which must look admirably in a gentleman's drawing-room. Still the body, as introduced in the engraving, is an improvement, and is what I recommended in my former statement, inserted in your 80th Number; but, upon the whole, my opinion of its merits remains unaltered; for unless the projecting sides and hearth-plate can be done away with, it will never be fit for the parlour; and, as respects a cooking apparatus, I again repeat it is totally out of the question, there being scarcely room or convenience even for a Welchman to toast his cheese.

I am, Sir,
Your humble servant,
T. J.

April 2, 1825.

EFFECT OF IRON MASTS AND IRON STEAM-CHIMNEYS ON THE COMPASS.

Professor Barlow having been requested to give his opinion as to the probable effect which the projected hollow iron masts (see M. M. p. 432, vol. III.) in men of war might have on the compass, he returned for answer, that he "thought it probable so great a surface carried above the deck would have a counteracting effect on the usual iron of the vessel, by bringing the common centre of attraction of all the iron nearly into a horizontal plane with the compass, and therefore, in these latitudes, nearly into the plane of no attraction, so as to leave it doubtful whether the actual effect would be the same as, or the reverse of, what happens in the usual cases. If the power of the mast prevailed over the other iron, the effect would be reversed; but if, on the other hand, it did not amount to so much, then the effect would remain the same in quality, but would be diminished in quantity."

Mr. Barlow has since made a series of experiments to determine the local attraction of steam-vessels, which present nearly a similar arrangement of materials to a vessel with an iron mast; the iron chimney standing in place of the mast, and the boiler and engine in lieu of the usual iron tanks, ballast, and guns. The result of these experiments fully confirms the theoretical opinion advanced by the learned Professor. The counteracting power of the chimney was rendered very obvious, the local attraction having been found very inconsiderable, and just such as might have

been predicted from the circumstance of elevating the common centre of attraction, as in the case of the iron mast above-mentioned.

It appeared from another set of observations which the Professor made with two compasses, one in the fore and the other in the aft line of the vessel (Comet steam-packet), that, with the ship's head to the east, the north end was repelled to the west, and with the head to the west, the north end passed to the east of its true bearing, which shows that the result was either due to the superior action of the chimney, or to some iron abaft the wheel, being *directly the reverse* of what generally takes place in the usual order of vessels in these latitudes "Whether this," says the Professor, "is the case in all steam-vessels with iron chimneys, may be worth the inquiry of those engaged in the navigation of them, particularly in those intended for voyages."

FRAUNHOFER'S REFRACTING TELESCOPE.

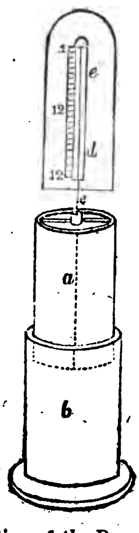
A Refracting Telescope, of extraordinary power, manufactured by the celebrated Fraunhofer, has just been erected at the Observatory of Dorpat. When in a perpendicular position, the height of the object-glass is 16 feet 4 inches (Paris measure) from the floor, 13 feet 7 inches of which belong to the telescope itself, so that the eye-glass stands 2 feet 7 inches from the floor. The diameter of the object-glass is 9 Paris inches (about 9⅗ inches English). The weight of the whole instrument is about 3000 Russian pounds. It is so constructed that it may be used as an equatorial. The upper part of the instrument consists of the tube, with its axis of motion, two graduated circles, and a variety of levers and counterpoises, producing the most perfect equilibrium in every direction, and providing against all friction. The declination circle is directed from 10′ to 10′, but, by means of the vermice, may be read off to 5″. The instrument may be turned in declination with the finger, and round the polar axes with still less force. The most perfect motion round the polar axes is produced by means of clock-work, which is the principal feature of this instrument, and the greatest triumph for the artist, the mechanism being as simple as it is ingenious. A weight, attached to a projection connected with an endless screw, overcomes the friction of the machine. The clock, vibrating in a circle, regulates the motion by moving an endless screw, connected with a second wheel in the above projection. The weight of the clock, as well as that of the friction, may be wound up without the motion being interrupted. When the telescope is thus kept in motion, the star will remain quietly in the centre, even when magnified 700 times; at the same time, there is not the least shake or wavering of the tube, and it seems as if we were observing an immovable sky. But the artist has done still more; he has introduced a hand on a graduated dial of the clock, by which the motion of the latter can be instantly altered; so that a star may be brought to any point of the field of vision to which it may suit the observer to carry it, according as it is required to make the course of the instrument go faster or slower than the motion of the heavens; and if once placed, it may be kept in that position by returning the hand to its original position. The same mechanism is also used to make the motion of the instrument coincide with that of the sun and moon.

This instrument has four eye-glasses, the least of which magnifies 175 times, and the largest 700 times. Professor Struve has compared the power of this telescope with Shroëter's 25 feet reflector, by means of which that astronomer saw the constellation of Orion twelve or thirteen fold; whereas Struve clearly ascertained the existence of sixteen distinct stars. This instrument is furnished with four annular micrometers of Fraunhofer's construction, and an excellent net micrometer of the same artist. By means of these, it appears that the probable error in the measurement of some minute distances, of 7″ and

under, did not exceed the 18th part of a second. The expense of this instrument was about 950l. sterling.

PLAN OF A WATER-CLOCK.

SIR—Your Correspondent C. D. Y. (p. 339, vol. III.) proposes a plan for a Clock without Wheels; it is ingenious, but I think, while he retains the cylinders, he will have gone but little way towards the accomplishment of his design; for though they may not be wheels by *name*, still their principle being the same, there are many who will call them so in *effect;* and a clock, to be properly without wheels, ought to have no part of it moving in a circular direction. Believing it to be possible to construct such a clock, I will, with your permission, lay the means before you.



Description of the Drawing.

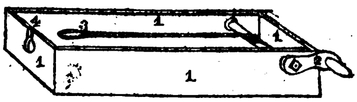
b is a vessel, open at the top, containing water; *a* is another vessel similar to *b*, but smaller in diameter, and of sufficient weight to sink; this vessel has, in the bottom, a small hole that will but just allow the water to pass: *c* is a wire fixed in the centre of *a*, as shown by the dotted line; *d* is a scale divided into hours, and numbered twice 12; *e* is a glass tube, let half-way into the scale, about half an inch in diameter, in which the upper part of the wire moves: the wire has a small flanch on the top. To set the clock going, the vessel, *b*, must be filled with water, when *a*, being empty, will, of course, be lifted into the position shown in the sketch. The diameter of this vessel may be regulated so as to allow a fall of nine or ten inches in the 24 hours: the fall (if the idea I have formed be correct) will become more rapid as it descends; but if it can be regulated so as to fall about 3-8ths of an inch in an hour, a nonius or vernier may be applied on the top of the wire, and may be divided to show the time to a single minute, whereas, unless the scale be very long, it will not do it to less than ten or eleven minutes, without crowding the scale.

I am, Sir,
Your obedient servant,
O'PINION.

February 23rd, 1825.

MACHINE FOR UNSINEWING TURKEYS.

SIR,—I beg to offer to the public, through the medium of your valuable publication, the Plan of a Machine I have lately made, by which the cook can, with ease, extract the Sinews from the Legs of Turkeys. The following is a rough sketch of it.



1111 is a trunk, fifteen inches long, three inches wide, and two inches deep; 2, a small winch, to which is attached the cord, 3, which, having a noose at the end, is fastened to the leg of the turkey, which, having been previously broken, is laid in the hole, 4; by turning the winch the sinews will be drawn out.

I am, Sir,
Your humble servant,
G. F.

REMOVING ATMOSPHERIC PRESSURE.

A Correspondent in our 74th Number, page 275, vol. III., mentioned that he had raised water to the height of eight inches, in a funnel, by the blast of a pair of bellows directed

over the mouth of it. A writer in Dr. Brewster's Journal of Science (No. IV., for April, page 243), states that, profiting by what he had thus read in the Mechanics' Magazine, he has "since found the principle of much service in the use of a syphon, for, by directing a blast from the mouth, through a tube rather larger than the syphon, in a direction nearly parallel with the leg, the liquid is raised over the bend, and thus begins to flow without the inconvenient process of filling it, as is usual."

STATE OF SCIENCE IN OUR DOCKYARDS.

[We have already given insertion (page 427, vol. III.) to one able answer to the presumptuous article in the Quarterly Journal on this subject; and though the writer of the following paper offers little that is decidedly new in the way of argument, he advocates the claims of our operative shipwrights with sufficient intelligence and zeal to entitle him to a hearing. He will perceive that we have omitted two or three passages of his MS.; we thought they were somewhat irrelevant to the main question. —EDIT.]

SIR,—On perusing the "Journal of Science," Article 12, No. 36, on Naval Architecture, and on the State of Science in our Dockyards, I felt surprise that a Journal of such high character should be the vehicle of a series of observations evidently designed to accomplish a particular object at the expense of persons who, in the execution of their professional duties, have been of the greatest service to the state.

Such an article, I think, demands some remarks, and I shall feel myself obliged by your allowing the following a place in your Journal :—

Alpha begins the article by referring to the experiments which are now making by the vessels constructed by Sir Robert Seppings, Professor Inman, and Captain Hayes, severally, and proceeds to express *his* wonder that the art of shipbuilding has been hitherto so "singularly neglected."

"By far the major part," he says, "of our present knowledge of Naval Architecture has been derived *from an imperfect experience*, the principles and maxims of theory having but little to do with its improvement."

Whatever, Sir, may be the claims of Alpha to knowledge of this subject, and by what means he has acquired that knowledge, I am unacquainted; I am inclined, however, to think that he will ever find that experience is the best teacher. Unhappily for society, the taste of the present day inclines too much to speculation and theory—experience is treated as a thing out of fashion, and the maxims founded on experience are deemed worthy only of contempt and ridicule.

Experience, Sir, is the effect which facts or experiments make on the understanding, or it is knowledge gained by practice. We have no more knowledge than we have experience. *Alpha* rightly assumes a suitable name, for he is certainly the first who, to perfect experience, would lead us to the study of theory. I would beg to recommend the contrary, and prove a theory to be correct by the test of experiment.

Unfortunately for Alpha, he contrasts civil with naval architecture, and thinks the contrast remarkable. I think it is remarkable, but quite in the contrary direction. It is remarkable that civil architecture has not made any advancements. No doubt the ancients very far surpassed the moderns on this subject, if we may judge by their mighty operations at Athens, Palmyra, &c. Who, in modern times, has written on this subject any thing new? And where is the edifice which can claim even equality with the famous buildings of old? St. Paul's Cathedral, by Sir C. Wren, is all composed of ancient science; the beautiful buildings of Greenwich Hospital are all ancient science. I am confident modern churches and other public buildings do not favour Alpha's assertion, unless we select, *for beauty*, the steeple of Langham-place Church, in Regent-street; and *for stability*, the noble edifice of the Custom-House.

The reverse is the case with naval architecture. Let any one examine

the construction of our ships of war; who, of the ancients, produced such pieces of mechanism? Begin with the reign of Henry the Eighth, travel century after century, and that mind must be dull in the extreme that cannot perceive the progress made in naval architecture, combining "those branches of knowledge on which ship-building so essentially depends."

Alpha asserts that "there is scarcely an element in which the naval engineer can predict with certainty what will be its effects when actually applied." Such an assertion is all theory—it is not even imperfect experience; it is rather (I say not ignorance) unacquaintance with the subject altogether. Alpha means to insinuate that such has been heretofore the ignorance of our naval engineers, that they could not predict the depth to which the vessel would be immersed when launched, nor its relative stability compared with other vessels when at sea, nor the comparative resistance it would meet from the water, nor if she will possess with certainty any properties, as weatherly, &c. I much fear Alpha has taken too much for granted, because of the unassuming habits of a class of persons whose engagements necessarily limit the sphere of their acquaintance, and whose situation precludes them from mixing with the scientific world.

I suspect Alpha apprehends that the persons on whom it has devolved to construct our ships of war, were deficient in science and imperfect in experience, because they have not become authors, and intruded themselves on the public notice by works of elementary philosophy. It is proper he should be informed, that though they do not boast of their science, yet, if a fair opportunity offered, they would not be found deficient in that measure of knowledge which would perpetuate their names in the estimation of good judges. Hence a Bately, a Sir T. Slade, names which probably Alpha never heard of, and probably the country has forgotten, but whose ships were the result of pure science, and not imperfect experience.

Let Alpha look to the operations in our dockyards, especially during a war of twenty-five years, and witness the activity, energy, and zeal of those who had the conducting of the business of them, and he will find that their attention was too much engaged, and their time too fully occupied, to allow of their figuring also in the field of letters. But are they to be deemed ignorant on that account?

If there be scarcely "a single element in which the naval engineer can predict with certainty what will be its effects when actually applied," I ask, how came it to pass that, during a long and arduous war, not one catastrophe or failure happened from the defective construction of our ships of war? Which of them sunk or overset? And is it not a fact beyond dispute, that they brought most of the enemies' ships into our ports, especially those of the French—a people whom, probably, Alpha will refer us to as purely scientific. I will readily and cheerfully admit, that much of the credit is due to our noble sailors, for bringing into our ports the ships of the enemy; yet, however skilful they may have been in naval tactics, or heroic in their military operations, unless the ships had possessed a superabundance of good qualities, they could not have "answered to the helm" so uniformly as they did.

Let it be always remembered, that the construction of our navy, and their equipment, all devolved, or was principally conducted and managed by two *practical* gentlemen, namely, the two Surveyors of the Navy.

I call on Alpha to inform me, in what respects our ships of war, either in their formation or construction, were inferior to the French in efficiency? What did they do, which our ships did not *out*-do?

I was not aware, when I took up my pen, that the subject would have afforded so much material; I could adduce a variety of facts to substantiate my position, but as they would bear on a subject to which Alpha alludes in his last page, I fear it would be considered invidious; I shall,

therefore, reserve that part of the subject until a future opportunity (if necessary), should Alpha again write so as to depreciate and degrade a useful class of people. I then shall not fail to state such facts in their vindication, as will at once prove, that experience has been the guide by which our ships have been constructed and built.

I remain, Sir,

Yours respectfully,

OMEGA.

MOTION OF THE ELECTRIC FLUID.

It has long been received as a fact, that an electrical discharge was capable of being transmitted through a very considerable distance (say two or three miles) instantaneously, and without any considerable diminution of its intensity. Mr. Barlow, however, by employing wires of various lengths, up to 840 feet, and measuring the energy of the electric action by the deflection produced in a magnetic needle, has found that the intensity diminishes very rapidly, and very nearly as the inverse square of the distance: hence the idea of constructing electrical telegraphs is quite chimerical. He found, also, that the effect was greater with a wire of a certain size than with one smaller, yet that nothing was gained by increasing the diameter of the wire beyond a given limit.

INQUIRIES.

NO. 114.

ORDERS OF ARCHITECTURE.

Why is the Composite Order, in Architecture, always placed over the Corinthian, since the composite compound of the Ionic, which is a stronger Order, must necessarily be more capable of supporting the Corinthian?

NO. 115.

HOW TO ADD HORSE OR OTHER POWER TO A WATER-MILL.

Suppose an overshot Water-mill, the wheel of which is as large in diameter as the height will admit to receive the water, to be so situated as not to have a sufficient quantity of water to turn the wheel during some of the summer months, in consequence of which near one hundred persons are kept idle; by what means can a small addition of force, by horses or otherwise, be employed to assist the wheel? and what will be best method of attaching the same?

CORRESPONDENCE.

The continuation of the article on the "Combination Laws," is unavoidably deferred till our next.

Aurum—We are not surprised at the circumstances to which he refers. It is quite in the usual course of things, that, where party is permitted to triumph, jobbing and corruption should come in their train. We shall, as he recommends, have an eye to the further proceedings of the parties.

We shall take the earliest opportunity of commencing the insertion of Amicus' paper.

Communications have been received from T. B.—Stultus—Mr. Wightman—Eam—Henry Ogle—R. R.—Mr. Dickenson—A. B.—Verulam—William Rogers—A Constant Reader—J. G.—G. T.—J. B. J.—G. Brown—Messrs. Watkins and Hill—Philo-Chess—T × S ×—Vibration—Timothy Trueman—R. Rs.—S. M. A. R.—Legion—H. D.—Tandem—P. Smart—Piercehall—M. X.—N. Sneyder.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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"Were every man to contribute but one new fact to the general stock of knowledge—and he has lived to little purpose who cannot do that—the world would, in one day, be a thousand times wiser than it is."—*Franklin.*

BORING APPARATUS,

BY M. MONNOM.

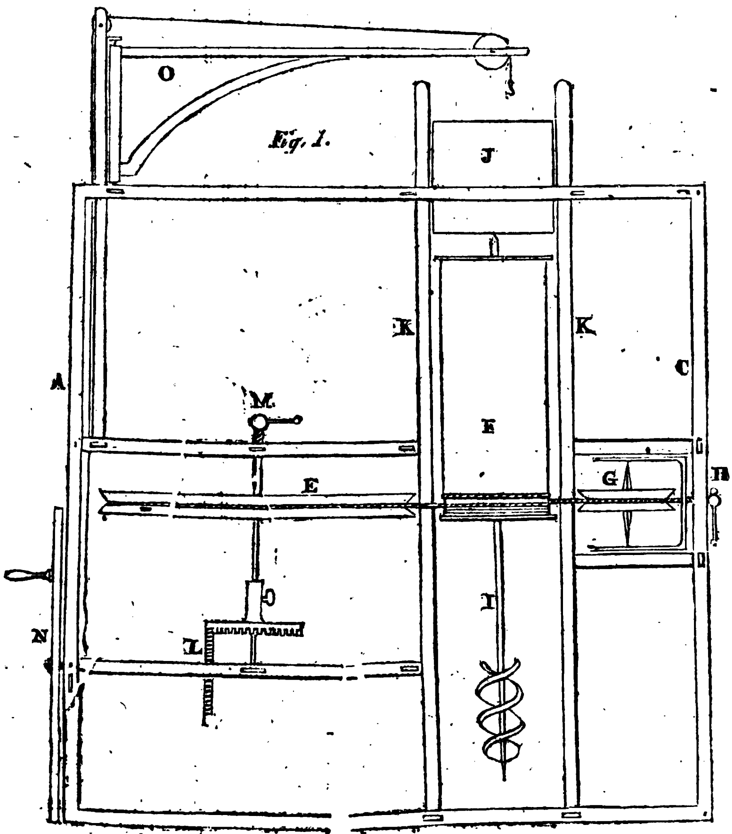


Fig. 2.

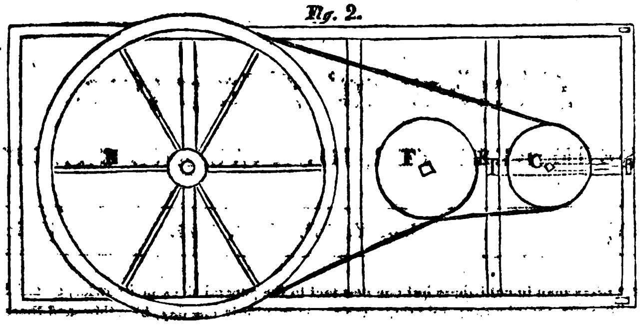
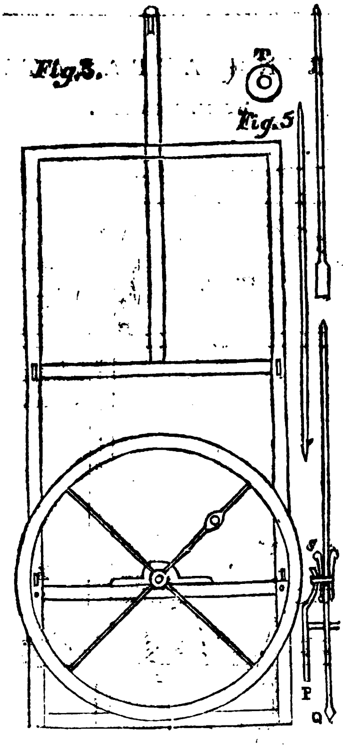


Fig. 3.

Fig. 5



BORING APPBRATUS.

SIR,—In the "Mechanics' Magazine" for December last, an inquiry is made for a Machine and Apparatus to bore for Water, and in many parts of this country I think such a machine is much wanted. To sink wells, where the springs lie deep, is not only tedious, but very expensive; in such situations people are obliged to put up with any thing like water, or to fetch it from a considerable distance. I have looked for a machine of the above description, but have never seen nor heard of one, more than that used by the carpenters to bore pump-trees, which requires great labour, and makes but small progress. For this reason I have sent you a plan of

one of my own inventing, which I hope will be found serviceable to the country.

I am, Sir,
Yours sincerely,
M. MONNOM.

Broadway.

Description.

Fig. 1 represents a side view of the machine. AC is a frame, of any convenient size, made of wood; I propose that it shall be six feet long, six feet high, and two feet six inches wide, for the convenience of going up passages in streets and buildings. E is a wheel three feet in diameter, on the circumference of which there is a groove, gradually narrowing to the bottom, and forming an angular indentation, which form is the most suitable to take effectual hold of the band. F is a cylinder made of wood, twelve inches in diameter, and two feet six inches long; at each end is fixed an iron plate, with a square hole to receive iron rods, which are made to slide easily through the centre of the cylinder. G is a pulley, nine inches in diameter, which acts on two centres in an iron frame; this frame is made to slide in the woodwork, and is acted upon by the screw, H, which tightens or slackens the band as occasion requires. I is an iron rod, six feet long, at the end of which is a spiral bit, made to bore a six-inch hole; the top end is rounded to a centre, and works in a brass socket on the bottom of the box, J. This box is filled with sand or shot, and slides down the two uprights, KK; the box, J, acts as a pressure on the rods, and keeps the cylinder in the centre. On the axle of the great wheel, E, is a cant-wheel and arbor, which is made to slide up or down, and is made fast by a thumb-screw at any degree, according to the size of the pinion that may be required to drive the machine. The pinion, L, is fitted on the axle of the fly-wheel, so that it may be taken off at pleasure to put on a larger or smaller. M is a screw to tighten the great wheel as the centres wear off. N is a fly-wheel, which is turned by a man, and gives motion to the machine; the line is coiled once round the cylinder, and brought over the pulley and great wheel, as is shown by fig. 2. When the cylinder is worked to the bottom of the frame, it is slided up the rods to its former elevation, and so on until the whole of the rod is worked down. The cylinder is then taken off, and another rod is introduced, which has a square socket to receive the end of the former; a pin is next put through the joint, which fastens them strongly together. O is a crane, provided with a chain, which hangs down, and may be attached to the axle of the fly-wheel to pull up the rods. The first bit, I, is intended to bore any soft substances, as clay, chalk, sand, &c.; and I think such a bit, from its spiral form, would clear its way, and raise the core to the top, where it might be cleared away with a shovel.

Fig. 2 shows the bottom of the frame, and wheels in their proper situation.

Fig. 3 is an end view of the frame and fly-wheel.

Fig. 4 is a bit, to bore through stone, coal, &c. PP are two pieces of steel, made widest at the lower end, and brought to a keen bevel, in favour of the cutting way of them. The end of the rod, Q, is steeled, and made flat in the shape of a drill; about a foot from the end is welded a piece of iron, with a groove at each end to admit the two cutters, PP, to slide up or down. R is a band of iron, made to slide down the rod; it must be long enough to receive the top ends of the cutters, with the two wedges, SS. Now, if you slacken one of those wedges, the cutters are at liberty to be slid up or down, or taken out to be sharpened. T is the core cut out by the drill. We will suppose the core, T, to be cut out of a bed of claystone, 30 or 40 feet below the surface of the earth; it would be difficult to get out, and another bit could advance while this core remained in, as it would constantly turn round with the nose of the bit, and prevent its cutting; to overcome this difficulty, the rods must be drawn up, and fig. 5 introduced; the end is made of steel, with an oblong mortice, in which are fitted two pieces of steel, so that when the rod is forced down, they may shut into the mortice; and when drawn up, they will open and take hold of the stone. Such a machine as the above would be very useful in boring wood, and drilling iron, or any kind of metal.

PROFIT AND DISCOUNT.

SIR,—Conceiving your friend M. W., on 'Profit and Discount,' in your 78th Number, page 342, to be in an error, I will take his advice, by "amusing" myself with trying the cause, Common Sense *versus* Mathematicus, beginning with M. W.'s own weapons.

Let S represent the gross amount;

D, the rate of discount;

N, the nett amount;

R, the rate of profit;

C, the prime cost.

$$\text{Then } S - \overline{SD} = N,$$

$$\text{and } N - \overline{NR} = C.$$

In M. W.'s example, "Suppose an article cost 50*l.*, on which it is wished to make $7\frac{1}{2}$ per cent. profit, what must the selling price be so as to be able to allow 3 per cent. discount?"

The answer he makes out is 55*l.* 412*d.*

Applying the above reasoning,

$55.412-\overline{55.412\times.03}=N=52.445$, and $52.445-52.445\times.075=C=48.512$, and not 50*l.*, as M. W. has it.

To illustrate—Suppose I sell goods which cost me 80*l.* for 100*l.*, my profits are one-fifth, or 20 per cent., and my cost four-fifths, or 80 per cent., the five-fifths being the whole, or the centum.

Again, if I sell for 100*l.* what cost me 20*s.*, M. W. would call this 9900 per cent., but which I should call mathematical nonsense, for the whole being 100, or the centum, he makes the parts to amount to more than the whole. The solution I propose is, that my profits are 99 per cent., or $\frac{99}{100}$, and the cost 1 per cent., or $\frac{1}{100}$, the parts being added to make the centum.

But what will M. W. say to the profit per cent. upon goods which cost him nothing: here he makes out $.0\times.075=0$, the amount of profit, and 0 added to this will be the amount of cost and profit, but which is much too abstruse for my apprehension, and I will therefore be content, in this case, with saying, that whatever amount the goods were sold for would be all profit, or cent. per cent.

Allow me to propose to gain twenty per cent., and allow ten per cent. discount.

$$N\times20=C\times x \quad\text{and}\quad \frac{N\times20}{C}=x,\ \text{therefore}$$

$$100\times20=80\times x \quad\text{and}\quad \frac{100\times20}{80}=x=25,\ \text{and}$$

$$S\times10=N\times y \quad\text{and}\quad \frac{S\times10}{N}=y,\ \text{therefore}$$

$$100\times10=90\times11.111\ \text{and}\ \frac{100\times10}{90}=11.111=y.$$

Example.—Let the prime cost of goods be 72*l.*

$72\times.25=18$, and $72+18=90$, and $90\times.11111=10$, and $90+10=100$, the selling gross amount.

But, to do away with algebra, which is often built upon false assumptions, I will descend to pure or unmixed mathematics, viz. plain arithmetic; and, as a general rule, taking 5 per cent. as an example.

Five per Cent. is equal to $\frac{5}{100}$, equal to $\frac{1}{20}$; supposing the centum divided into 20 parts, the profit will be 1, and the cost 19 of those parts; therefore, dividing the cost by 19 will give the profit of 5 per cent.

And, universally, whatever the fraction may be, $\frac{1}{20}$, $\frac{1}{19}$, $\frac{1}{18}$, $\frac{1}{10}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$, the divisor of the cost will be 19, 18, 17, 9, 3, 2, 1, &c. &c. and the quotient will be the profit which is to be added to the cost.

The same process, in all respects, will show the discount to be added to the nett amount, making the gross amount of sales.

The above is the constant practice of a very large manufacturing district, and I should not have troubled you but for the gross blunders frequently met with in the daily papers when speaking of profits.

I am, Sir,
Your obedient servant,
AN OLD MANUFACTURER.

Birmingham, March 15, 1825.

IMPROVED THREE-WHEELED CARRIAGE—NOTICE, ALSO, OF A SIX-WHEELED CARRIAGE, INVENTED BY SIR SIDNEY SMITH.

SIR,—I observed, in a late Number of your useful Magazine, a sketch and description of a Three-wheeled Carriage: but, as I cannot perceive any difference between it and the common chairs and carts long in use on that principle, always found defective in wear, from the leverage action of the fore-wheel on the revolving spindle, which is so much above the centre and bearing of the wheel; and as the gentleman alludes

to me, from a notice of a new construction of a three-wheeled carriage of mine, which you favoured with a place in your Magazine a few months back; I beg leave to state, that any person who may be desirous of knowing the novelty of the principle, can obtain every information respecting it by application.

I have lately resided in Paris, where several four-wheeled carriages, on a new construction, have been made, and generally admired for their *safety*, *ease*, and *lightness*. The simplicity of the construction admits of their being built for considerably less than the ordinary principle of poney phaetons, and likewise kept in repair, while they can be made to evade whatever duty is imposed on the common four-wheeled vehicles. The mode of attaching the shafts to the car preserves the stability of the machine, in case of the horse falling, &c.

I have to inform you of a six-wheeled carriage, on an ingenious and novel principle, lately invented by *Sir Sydney Smith*, which has been found of considerable utility for invalids and persons unable to bear the motion of the ordinary carriage, from its extreme ease on uneven pavements. It is likewise of peculiar advantage for travelling over bad roads, and for crossing open countries, for which purpose it forms an excellent sporting carriage. If you will favour it with a place in your Magazine, I will furnish you with a design and description of it.*

Any individual wishing to have a three or four-wheeled carriage, on the new principle, may be furnished with any information they may require by sending their address to No. 25, Bow-street, Long Acre. Likewise for the six-wheeled carriage.

I remain, Sir,
Your obliged and obedient servant,
G. M.

* We shall gladly give it a place.

RAREFACTION OF AIR.

Sir,—Your Correspondents, Mr. T. Hartshorne, page 274, and Phylo Sates, page 423 (vol. III.), appear to entertain some doubts with regard to the phenomena attendant on the rarefaction of air by heat. They agree in stating that, if the open end of a tube be placed in the fire, and its lower extremity be immersed in a basin of water, that the water will rise so far in the tube; and this rise of the water appears to them a most inexplicable arcanum. Now, without arrogating any degree of superior judgment, I am really compelled to say, that I see no reason why it should be otherwise; for it is an established principle, that the particles of air, when heated, expand or occupy a larger space, that is, they become specifically lighter than the surrounding air; they will, therefore, ascend to such a height in the atmosphere as corresponds to their bulk and density, and the adjacent air rushing in to supply the place they had formerly occupied, will, from this natural effect, prevent any sudden or great derangement of the equilibrium from taking place. Now, this upward current of rarefied particles being incessant, and as the force and velocity in that direction may be increased to any extent, by increasing the heat, it follows that the air flowing in to supply this waste will rush to that point which offers the least resistance to its ingress, and if the lower part of the tube were out of the water, the *adjacent air would rush through it*; and since air or any other body cannot move through any aperture without exciting in our minds the idea of *force*, it necessarily follows, that if a cup of water is placed at the bottom of the tube, that that water will rise upward in it, and continue suspended as long as the same degree of heat continues at the top of the tube. Thus we see that the top of the tube is guarded from the pressure of the superincumbent air by the rapid ascent of the aërial bubbles.

As a practical illustration of this subject, suppose a balloon to be placed in a tube so as to embrace its sides in the most perfect manner, and without friction. Let the lower part of the tube be placed in a large vessel of water, inflate the balloon either

by heated air or hydrogen gas, and it will instantly *struggle* to get out of its confinement, in consequence of its being specifically lighter than the air in the tube, and the natural consequence resulting from this will be, the air under the balloon will expand, because it occupies a greater space from the ascent of the balloon, and, in order to restore the equilibrium, the external air will press up the water into the tube to such a height as will balance the tendency of the balloon to ascend; so that the water will rise in the tube in the exact proportion as it would have done, had the air within the tube been rarefied to the same degree of *lightness* as that in the balloon. The two cases I consider as *nearly* analogous; the particles of heated air, in the former case, becoming, in fact, *little Montgolfiers.*

One might descant on a great many practical cases to prove the cause of the ascent of the water in the tube. The following appear to be regulated by *nearly* the same principle: The ascent of the flame in Argand's burner and chimney, ballooning, Dr. Halley's marine gauge, letting foul air out of the diving-bell, air furnaces of every description, ascent of vapours in the atmosphere, *water spouts at sea*, &c. &c.

Mr. H. asks, at the end of his letter, "What subverts the rarefied state of the included and insulated air?" I answer, leakage. The following experiment will prove this:—Take a large wine glass, and fix a piece of paper on its bottom inside; set fire to this paper, and the included air being thus rarefied, or, what is the same thing, becoming specifically lighter than the surrounding air, the consequence is, the particles are forced out of the glass by their mutual expansion, a partial vacuum being thus formed. If the glass is plunged into a saucer of water, with its mouth downward, the water will rise in the glass (after the internal air collapses), from the external pressure of the atmosphere, and may be retained there for any length of time.

Phylo Sates draws a most unphilosophical conclusion, when he says: "So that, from the fact of water ascending in consequence of reduced atmospheric pressure, and the scale ascending in consequence of increase of pressure, the inference is nothing less than this paradox—that air, rarefied by fire, has *a less* and *a greater* pressure than the atmosphere, as it *naturally exists.*" Here is obviously a direct contradiction, for a thing cannot be greater and less than a given thing at the same time. He speaks, also, of water ascending by *reduced* pressure, and an inverted cone ascending by an increase of pressure. This last certainly is true; but the water also ascends, because, RELATIVELY, there is an increased atmospheric pressure forcing it up the tube.

Should the above remarks dispel the doubts of your Correspondents, I shall consider my time and paper spent to some advantage; and if they only tend to increase those doubts, I shall, in a subsequent Number, attempt to set this subject in a clearer point of view. BUT should THEY *prove to me* that I have only been raising up "bubbles light as air," then let me conclude with the words of the poet—

"'Tis hard to say if greater want of skill
Appear in writing, or in judging ill;
But, of the two, less dangerous is th' offence,
To tire our patience than mislead our sense."

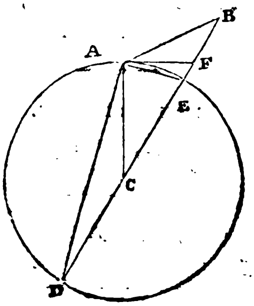
I am, Sir,
Your humble servant,
JAMES YULE.

63½, Red Lion-street, Clerkenwell.

ON MEASURING THE HEIGHT OF OBJECTS.

SIR,—As some of your readers, no doubt, would wish to be acquainted with the method of determining the quantity of depression of two distant objects on the surface of the earth, and also the principles upon which that depression is founded, allow me, therefore, to contribute a few lines to your miscellany for furthering this object.

In measuring the height of any object, the angles are usually determined by the application of spirit levels to the angular instrument, or, simply, by the plummet; but when the objects are very distant, it is evident that this method will require some correction, and, for this pur-



pose, let A and B represent two remote objects; C the centre of the earth, to which all bodies gravitate. Join AB, BC, and produce it to D; draw AF a tangent to the circle, and join AE, AC, AD. Now the converging lines AC, BC, will indicate the direction of the plummet at A and B, and the tangent AF will mark the line of the horizon from A. Again the angle, as measured at A, by the instrument, is only the angle FAB, which is less than the true angle EAB by the angle EAF. But by a well-known property of the circle (Euclid, Lib. 3, Prop. 32), the angle EAF is equal to the angle ADB, and this again is equal to half the angle at the centre, viz. ACB. Hence the true angle EAB = FAB + half the measure of the intercepted arc AE; but as this measure depends upon the curvature of the earth, which is neither uniform nor regular, the measure for each particular place must be deduced from the corresponding degree of latitude.

In ordinary calculations, however, such nicety is unnecessary; we will be sufficiently near the truth if we assume the earth as a perfect sphere, whose circumference is 24856 miles; the arc of a minute upon the meridian will, therefore, be 6076 feet; the correction to be added to the observed vertical angle will, therefore, amount to one second for every 69 yards contained in the intervening distances betweeen the objects.

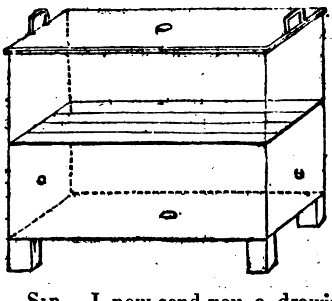
From what we have stated, the quantity of depression, FE, is easily found; for, from Euclid, Lib. 3, Prop. 36, $AF^2 = DF, FE$, or very nearly DE, EF, and from this equation we conclude that the depression of any object is always proportional to the square of its distance, AF; consequently, in the space of one mile, this depression will amount to $\frac{5280}{7912}$th parts of a foot, and generally we may express it in feet by two-thirds of the square of the distance in miles; but this depression, arising from the earth's curvature, is modified in a small degree by another cause, arising from the refraction of the rays of light in passing through the atmosphere; and this trajectory may be considered as very nearly the arc of a circle, having for its radius about six times the radius of our globe, or about 23736 miles. Now, in order to correct this error, we have only to diminish the effect of the earth's curvature one-sixth, or, what is equivalent, deduct from the vertical angles the twelfth part of the intervening terrestrial arc.

I am, Sir,

Your obedient servant,

Nicol Dixon.

STEAM WASHING-BOX.



Sir,—I now send you a drawing of a Family Steam Washing Machine, which I promised in my last (page

20, vol. IV.). The figure represents a strong deal box, resting on pedestals, of an oblong shape, and about four feet long. According to the height in the clear, shelves are to be fitted, so as to rest on cleats, and be removable at pleasure. The distance between the shelves should be about six inches, and the shelves are to be formed of bars or laths, so that each shelf may consist of a single perforated frame, similar to a gridiron. The cover, which takes off, is to be steam-tight; and when on, is to be fastened by a bar that runs through the two projecting staples. A puppet-valve is to be inserted into the cover, and supported so that it may rise and fall without being thrown out. A cock, or spigot and faucet, is to be inserted in the side, and close to the bottom.

The manner of proceeding is as follows:—The linen are to be first rubbed separately with hard soap, then placed on the lowest shelf (the fewer pieces the better), and spread at full length; then put a shelf over these on its rest, with soaped linen on it; then another shelf, and so on; observing to act so as to promote the transmission of the steam as much as possible through the linen.

A pipe, having a stop-cock in some part of it, being inserted in the top of the wooden vessel of the boiling machine (p. 20), is likewise to be inserted in the side of the steam washing-box; then it is only necessary to turn the stop-cock by which the steam enters, and the process of steam-washing goes on. After some time, turn the cock of the washing-box, to let off the dirty water; do this at intervals, and when the water is perfectly clear, the linen is strained enough. The linen is then to be taken out and rinsed, when it is fit for drying.

Wood that yields colour and turpentine, and metal on the inside of the box, are to be carefully avoided.

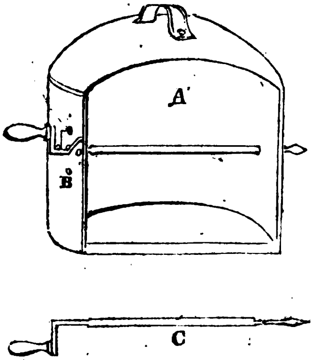
Should the steam from the water-box not be strong enough, it may be obtained from a common cooking kettle, the lid of which has a three-inch tube in length soldered in it, to admit the junction of the above-mentioned service-pipe; which pipe being removable from both the boiler and the steam-box, the latter can be laid by in any convenient place until again wanted.

I am, Sir,

Your obedient servant,

HASPY SMOLET.

IMPROVED OVEN.



SIR,—The above sketch of a very simple and economical method of Roasting small Joints, is found to answer remarkably well; if you think it worthy your notice, it is at your service.

I am, Sir,

Your constant Reader,

F. I. L.

March 7, 1825.

Description.

A is a Dutch oven (any common Dutch oven will answer the purpose).

B, five holes; through the centre one the spit is put; the others are to receive successively the hook which keeps the spit in the position required.

C is the spit.

There is a slit cut immediately under the five holes, to take the spit out, with the meat on.

DESCRIPTION OF THE DANAIDE, A MACHINE ACCELERATED BY FRICTION.

Fig 1.

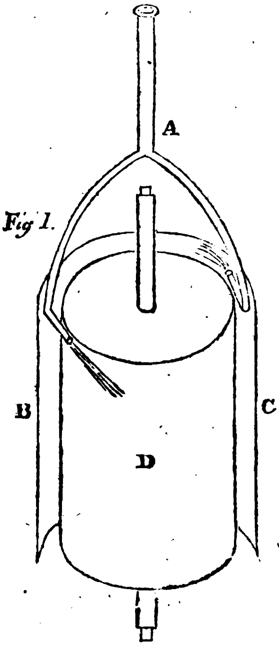
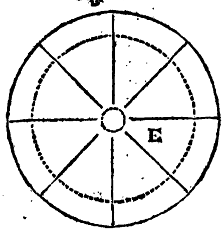


Fig. 2.



SIR,—Although the effects of friction are an insurmountable obstacle to the engineer, yet, nevertheless, there are some machines wherein friction, instead of retarding, actually accelerates the moving force; and I beg leave to place before you the drawing of a machine, where this assertion is strikingly exemplified. As I have never seen any drawing or model of this machine as it came from the hands of its inventor, M. Mannoury Dictot, yet I have endeavoured to supply this defect to your readers from the description, as given of this machine by Messieurs Périer, Prony, and Carnot, in their Report to the French Institute. These gentlemen also tried to ascertain what might be the amount of the effect produced by the Danaide (for that is the name of the machine), by fixing pulleys in such a manner as to raise a weight from the ground, and, by many repeated trials, they discovered that 7-10ths, and sometimes 75-100ths of the moving power, was the effect produced—an effect, in fact, which is greater than any machine that we are acquainted with. The model by which Dictot exhibited his experiments, consists principally of a trough, the bottom of which has a hole

in its centre; it is cylindrical, nearly as high as it is broad, and made of tin plate. It is fixed to a vertical axis of iron, which passes through the middle of the hole in the bottom, leaving a vacant space all around, through which water escapes as it flows into the trough from above. This axis turns with the trough upon a pivot, and is fixed above to a collar. The object of the inventor was, that the water flowing into the trough from above, with a certain quantity of *vis viva*, should communicate the whole of it to the solid parts of the machine, so as to be employed afterwards in producing some useful effect, always excepting the small quantity of force necessary to enable the water to escape by the orifice below. This object he thus obtains:—Within the trough there is affixed to the axis a drum, likewise of tin plate, concentric with the trough, and close above and below; this drum, which turns round with the trough, occupies nearly the whole of its capacity, the space between the two not exceeding an inch and a half: a similar space exists also between the bottom of the trough and the drum; it is, however, less than the former, and is divided into several compartments, by diaphragms proceeding from the circumference to the central hole in the bottom of the trough. These diaphragms do not exist between the sides of the drum and the trough, and the compartments of the bottom communicate with this annular space. The water, which comes from a reservoir above, by one or two pipes, makes its way into this annular space between the drum and the trough; the bottoms of these pipes correspond with the level of the water in the trough, and they are directed horizontally, as tangents to the mean circumference of the trough and of the drum. The force which the water has acquired by its fall along the pipes, causes the machine to move round its axis; and this motion gradually accelerates, till the velocity of the water in the space between the trough and the drum equals that of the water from the reservoir, so that the shock of the water from above upon that in the machine becomes imperceptible. Now this circular motion communicates to the water between the trough and the drum a centrifugal force, in consequence of which it presses against the sides of the trough. The centrifugal force acts equally upon the water contained in the compartments at the bottom of the trough, but obviously less and less as the water approaches the centre. The whole water then is actuated by two forces, which oppose each other, namely, gravity and the centrifugal force. The first tends to make the water run out at the orifice at the bottom of the trough, the second tends to drive the water from that hole. To these two forces are joined a third, namely, friction, which acts an important and singular part, since it promotes the efficacy of the machine; while in other machines it always diminishes that efficacy. Here, on the contrary, the effect would be nothing, were it not for the friction, which acts in a tangent to the sides of the trough and drum. By the combination of these three forces, there must result a more or less rapid flow from the orifice at the bottom of the trough, and the less force the water has as it escapes, the more it will have employed in moving the machine, and consequently in producing the useful effect for which it is destined. The moving power is the weight of the water running in, multiplied by the height of the reservoir from which it flows above the bottom of the trough, and the useful effect is the same product diminished by half the force which the water retains when it issues from the orifice below. The prefixed Drawing of this Machine will convey some idea of its construction to your readers. I consider this machine as being worthy the attention of the practical engineer.

I am, Sir,

Your most obedient servant,

JAMES YULE.

Description of the Drawing.

Fig. 1. A represents the main for conveying the water; BC, the trough, the bottom and one side being taken away; D, the drum, with its axis; E, the bottom of the trough, as divided into compartments, &c.

Fig. 2, section of the bottom of the trough, with the diaphragms; the dotted circle represents the drum.

ENCOURAGEMENT OF INVENTIONS AND DISCOVERIES.

In the course of our editorial avocations, nothing has been more frequently and painfully forced upon our attention, than the difficulty which men of genius, who are in humble circumstances, or resident in remote parts of the country, experience in turning their inventions and discoveries to practical account, for the benefit of themselves and the public. Our table is covered with letters from individuals thus situated: some stating their inability to bring forward designs, which they conceive to be of undoubted utility; others submitting hints and suggestions, which they wish to be subjected to

the test of experiments, the expense of which they are unable to defray, or do not feel themselves justified in risking; others, again, complaining, that improvements which they have perfected, and the right to which they have secured to themselves, remain neglected and unproductive, from the insufficiency of the means that have been employed to introduce them into general use; and all soliciting, in one shape or other, assistance, which we have been able in but a few instances to grant or procure for them.

The recurrence of these circumstances has led to steps for the formation of a joint stock association, to be entitled, "The British Invention and Discovery Company, for the Assistance, Encouragement, and Protection of Native Genius, and the profitable Investment of Capital, in the prosecution of original Inventions and Discoveries by British Subjects." The proposed capital is 750,000*l.*, to be raised in 15,000 shares of 50*l.* each. The scheme was first publicly announced on Monday last, and already there are *more* than the whole number of shares applied for. The time for receiving applications, however, extends to the 7th of May; and it being obviously of great importance to the interests of the Company that it should spread its roots as widely as possible, it is likely that the distribution of shares will be regulated more by that consideration than by mere priority of application. A more specific prospectus of the objects of the Company, with the names of the Board of Management and other Officers, is to be issued at the close of the time for receiving subscriptions. Such of the friends and correspondents of the Mechanics' Magazine as may be desirous of procuring shares, may address their applications to the care of the Editor.

COMMON ERRORS IN MEASURING ROUND TIMBER.

Sir,—Though I do not claim the honour of being the first to expose the errors of the common method of Measuring Round Timber, yet I am a little gratified in being the first to show its errors to the readers of your very valuable and justly popular Magazine, and I have no doubt but many of them feel obliged to me for doing so, in a manner capable of being understood by the most illiterate; nor am I at all surprised that there should be found advocates for so palpably erroneous a method, when I consider that every mechanic has been taught, almost from his infancy, to believe it as infallible. Your Correspondent "T. M." has said all that he can say in its defence, but he must not forget that "old men are not always the wisest;" for though I have not arrived at that age when the law considers a person capable of being his own master, yet I certainly think that my knowledge of the subject in hand is quite equal to his, though he be an old man. But, without farther ceremony, I shall proceed to make a few remarks on his last letters; and, in the first place, I consider his supposition of a tree in the form of a triangular prism as perfectly ridiculous. There never was a tree that grew in that shape, or ever approximated toward it; and if we are to make such suppositions, it will be impossible to find even an approximate rule to suit every case that may be *supposed*, for the circumference of a span may be infinitely great, while the span itself, or its area, may be infinitely little; it is, therefore, evident, that if we consider trees under any form that they may be supposed to have, and not as they naturally are, that no rule which directs to take the circumference in order to find the content, can be used with any accuracy in every case that may be *supposed*. Thus we may *suppose* the sections of a tree forty feet long to be right-angled parallelograms, the longer sides of which are 23½ inches, and the shorter half an inch, and consequently its solid content is 3 feet 3 inches; while by the common rule its content shape would be found to be 40 feet. But who ever saw a tree growing in this form, or in that of a triangular prism? Every person at all acquainted with timber knows that its shape is generally circular. In my reply to T. M.'s former letter, I gave the true content of a tree 40 feet long, and 48 inches in circumference, every section of which, at right angles to the axis, was an ellipsis, having its transverse diameter 17, and its conjugate 13.3 inches, and showed that the difference between its true content and its content, as found by calculating it as a cylinder, was but 1 foot 8 inches, while the difference between its true content, and its content as found by the common rule, was 9 feet 3 inches; and yet T. M. still persists in saying, that that rule is as correct as any other. He also tells us, that "the ellipsis being a regular curvilineal figure, does not greatly vary from a circle, but contains

more within its circumference than any other figure of the same proportion." By this I suppose we are to understand, that Measurage very well knew, that if he did not consider trees as elliptical, he could not make his case appear so plausible as "an ellipsis being a regular," &c. Here your Correspondent has fallen into a sad mistake; and I beg leave to inform him, that the primitives of an ellipsis may infinitely exceed that of a curve, and yet its area may not be so great. The reason why I considered the tree as elliptical, was, because I know that they generally approximate nearer to that figure, or to that of a circle, than to any other figure whatever. I know they are never perfectly of one figure or the other, but the variation is too insignificant to be noticed in timber-measuring. Since I wrote my last letters on this subject, I have examined a great number of trees, and I have not found one in a hundred with so great a degree of eccentricity as the one above named; and as there are ninety-nine out of a hundred that have a less degree of eccentricity (indeed, the sections of a great many approach so near to circles, that the difference is not worth notice), we may safely conclude, that the difference between measuring it by considering its sections as circles, and its true content, in a number of trees which hold of the same size from one end to the other, would not be more than 9 inches in 40 feet; whereas, by the common rule, that difference would be nearly fifteen times as great; and I think it will be allowed by every person of common sense, that when perfect accuracy is unattainable, that rule which approximates nearest to it is the one that ought to be adopted by every person at all concerned in the matters. But without insisting farther on this point, I come now to show, that the rule which T. M. tells us was first introduced by me, actually gives the content of almost every tree too little. This may appear paradoxical to him; but I suppose he will admit, that trees seldom grow of the same size from one end to the other, but are generally in the form of the frustrum of a cone. Now, the solidity of a frustrum of a cone, expressed in algebraic terms, is this:—$\frac{D^3-d^3}{D-d} \times p \times \frac{L}{3} = (D^2 + Dd + d^2) \times p \times \frac{L}{3}$, where D = the greater diameter, d the lesser, p the area of a circle whose diameter is unity, and L the length. The solidity of a frustrum of a cone, calculating it as a cylinder, by taking its diameter in the middle, is $(\frac{D+d}{2})^2 \times p \times L = (D^2 + 2Dd + d^2) \times p \times \frac{L}{4}$, which is less than the former expression by $(D^2 - 2Dd + d^2) \times p \times \frac{L}{12} = (D-d)^2 \times p \times \frac{L}{12}$, and, consequently, when trees are conical (as they generally are), the rule for calculating the solidity of a cylinder actually gives the content too little by $(D-d)^2 \times p \times \frac{L}{12}$.

The following examples will make this appear plain to those who may not understand the algebraical process.

Ex. 1.—What is the solidity of a tree 40 feet long, and 24.54 inches diameter at the greater end, and 6 inches at the lesser?

Ans.—Its true content will be found 57 feet 1 inch, which is 6 feet 2 inches, or $(24.54-6)^2 \times .7854 \times \frac{40}{12}$, more than would be made by taking its diameter in the middle, and calculating it by the rule for a cylinder, and 17 feet 1 inch more than by the common rule!

Ex. 2.—What is the solidity of a tree 40 feet long, the sections of which, at right angles to the axis, are ellipses, having their diameters at the greater end 24 and 18.6 inches, and at the lesser 10 and 8 inches?

Ans.—52 feet, which is one foot and one inch more than would be made by girting it in the middle, and calculating it by the rule for a cylinder, and 12 feet more than by the common rule.

With such proofs as these before their eyes, surely no persons will be found hardy enough to assert that the common method of measuring round timber is as correct as any other.

I think this cannot fail of convincing even T. M. himself; but, as he is not willing to receive a rule from a young man, perhaps the following quotation from "Leybourn's Complete Surveyor," printed more than a hundred years ago, will do more towards convincing him of his errors than all which I have said; it will, at least, show him that I am not the first who has "attempted the cylindrical method."

"As there are grand customary errors continually committed in the mensuration of unequal-sided and tapering timber, so there is one also in the measuring of round timber, which transcendeth them all, and that is this:—In timber trees they usually girt the tree about the middle of the trunk thereof with a line, and take one-fourth part of that girt for the side of a square, and with this they find the content of the tree as if it were a square whose side is equal to a fourth part of that girt; but this is egregiously false, for it always gives the

content of the tree to be near, and most commonly above, one-fifth part less than the true content. But, for the maintaining of this ill custom, they plead the overplus measure may be well allowed, because the chips cut off are of little value, and will not near countervail the labour of bringing the timber to a square, to which form it must be brought before it be fit for use. To this I answer, that although the chips in small timber sticks be but of small value, yet, in great trees, there be large slabs, and so the labour of hewing is not lost, and only the chips allowed; but, notwithstanding, I do not say that timber standing ought to be measured falsely, but truly, and if any allowance be to be made, let it be in the price, and not in the *quantity*; and, as the *quantity* will be 1-5th part more than in reality it is, so a fifth part might rather be abated in the price. Besides this, if timber be thus measured, and bought when it is round, I say that a tree, when it is hewed, and brought to such a square as timber is usually brought to, and measured as it there is hewed, that timber stick shall then hold out more measure than when it was bought round. Divers other errors in the mensuration of solid bodies have crept in for the lack of art, and the ignorant being possessed thereof do plead prescription and custom, whereas custom cannot establish a law upon a bad foundation and false ground, neither can error prevail against truth, nor ignorance convince reason supported by art, upon demonstration."

Before I close this subject, I beg leave to recommend to the notice of your readers the rule for measuring round timber first proposed by Dr. Hutton; it is much more correct than the common one, and nearly as easy in practice. It is this:—Multiply the square of one-fifth of the girt, or circumference, by twice the length, and the product will be the solidity nearly. The truth of this may be demonstrated as follows:—

Let g = the girt, or circumference, and L the length, thus: $\left(\frac{g}{5}\right)^2 \times 2\,L = \frac{g^2\,L}{12.5}$, the content of the tree according to the above rule; and the true content, measuring it as a cylinder, is, $g^2 \times \frac{1}{2 \times 3.1416} \times \frac{1}{2} \times L = \frac{g^2\,L}{12.5664}$; the difference between which and the former expression is not worth notice.

I am, Sir,
Your most obedient servant,
MEASURAGE.

P. S.—The tree, whose circumference I stated was 148 inches, should have been only 138.

BELL-HANGING.

Fig. 1

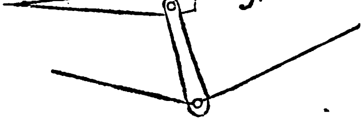


Fig. 2.

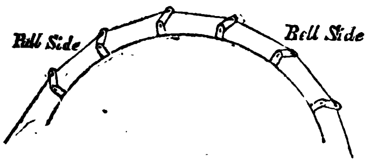
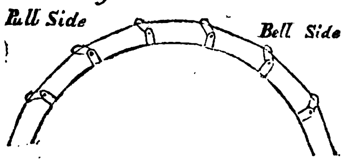


Fig. 3.



Sir,—Seeing in a late Number of your Magazine an improvement on the Bell Crank, by a Country Smith, and a reply to it, in Number 83, from a London Smith, I beg leave, through the medium of your useful work, just to let these gentlemen know, that I am so unhappily stupid,

as not to perceive that either of them has made any improvement at all. I am employed every day in the year, Sunday and holiday excepted, at bell-hanging, and I never met a situation, either bevel or circular, internal or external, but what the common bevel crank was perfectly adequate to. The only improvement that I could ever make, was to file off one of the eyes, when working round an obtuse angle, and putting both wires in the other.

Fig. 1 represents the bevel crank.

Fig. 2, the circular wall and bevels.

Fig. 3, the same when the bell is drawn.

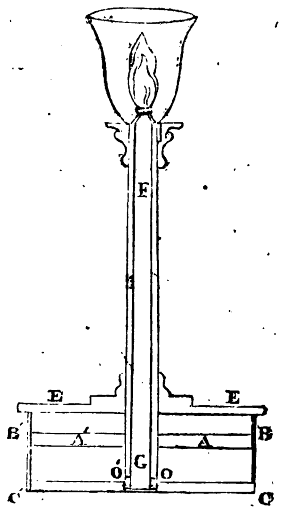
There is another difficulty in bell-hanging which I consider a real one, namely, that of boring perfectly horizontal for door-pulls. Now, Sir, if either of your bell-hanging Correspondents would just oblige us with an improved method of the above, or an infallible method of detecting a crooked bore, it would be doing a service, for which they should have my warmest thanks, and more than mine, I well know; for only to a bell-hanger is known the grief of mind felt, when, after entering, as he thinks, perfectly horizontally, and boring two feet, or two feet six inches, he finds himself an inch, or an inch and a half, out of course. Boring an oak-case, too, is no treat.

I am, Sir,

Your obedient servant,

A. S.

SINUMBRA LAMP, ON THE PRINCIPLE OF THE HYDROSTATIC PARADOX.



Sir,—I beg leave to offer to your notice a plan for a Sinumbra Lamp, on the principle which is called the Hydrostatic Paradox.

Description.

FG is a hollow brass pillar, screwed into CC, the base of a smooth brass cylinder, BC CB, and communicating by two holes, OO, with that cylinder. AA is a brass annulus or ring, whose outer circumference fits close to the cylinder, B C C B, and whose inner circumference fits close to the cylindrical stump of the pillar. EE is a cover for the cylinder, and may be made to represent the base of a Grecian pillar. This top or cover being taken off, oil is poured into the cylinder, and the brass ring or annulus being then placed over the oil, rests on its surface, and presses it up to a certain

height in the pillar, and thus produces a constant supply from within, in the same way that the common lamp is supplied from without. The variation of the altitude of the oil in the pillar is equal to the depth in the cylinder; hence, if the breadth of the cylinder is great, the variation of the altitude of the oil will be small. The glass placed on the capital of the pillar may be spherical, or of any other shape, and will cast no shade.

I am, Sir,
Yours respectfully,
F. O. M.

DUTY ON IRON, COPPER, ZINC, ETC.

An intelligent Correspondent, in our 82nd Number, complained of the extravagantly high price which iron has recently attained, in consequence of the inadequacy of our home supply of that article, and urged the policy of permitting a free import of foreign iron, in order to bring the price of this necessary commodity to its proper level. We have since observed, with much pleasure, that a large reduction of the duty, not only on foreign iron, but on foreign metals generally, is one of the many beneficial measures which his Majesty's Ministers (the greatest radical reformers we know of) have brought into Parliament for the promotion of the manufactures and commerce of the country. Mr. Huskisson, in proposing this reduction, mentioned some very striking facts in support of it.

"He knew," he said, "that there were at the present moment extensive orders in Sheffield and Birmingham—some of them from North America, others from several parts of the South American provinces—which could not be executed, because they were sent with a limitation of price; and he also knew that very many individuals were now employed in making models of the kind of articles wanted, which were to be sent off to Germany, where the orders could be executed at a very reduced price.--(Hear, hear.)—Was not this, he would ask, quite enough to show the great importance of having those duties reduced? Was it not an injurious monopoly, thus to exclude a foreign supply, and confine the market to the produce of the country, which was really not sufficient to supply the general demand. It was of the utmost advantage to this country to have, in the manufacture of many articles, a mixture of foreign iron, particularly Swedish, which was superior to the iron smelted with coal. The want of a sufficient supply of that iron (in consequence of the high duties) had caused a deterioration in the quality of several important articles of our iron manufacture, and would produce a consequent diminution of the demand. In the manufacture of iron cables, for instance, which had of late come into very general use in our ships, a mixture of Swedish iron was considered of great advantage, and those cables in which it was used were considered the best. Here, then, a most important benefit to our naval interests might be counteracted or prevented by continuing the present high duties: the reduction of duty on this article was on every account advisable. The next article upon which he intended to effect a reduction was copper. The state in which the English manufacturer was placed by the high duty on iron was not more injurious than that in which he was placed by the high duty on copper. The duty on the importation of copper was at present 54*l.* per ton. Now, if we attempted to maintain the duty at this high rate, and to keep up the price of our copper manufactures accordingly, it was evident that we must ultimately be driven from the market by our incompetency to contend with the foreign manufacturer; whereas, if we lowered the duty, and so enabled our manufacturer to furnish a superior article at a lower price, we should soon become the manufacturers of it for the whole world. The consumption of copper amounted at present, in each year, to 10,000 tons, of of which 4000 or 5000 were used at home, whilst the remainder were exported to the foreign market. Now, the owners of copper-mines must see, that if by the high price at which the manufacturer bought copper, he should lose his hold upon the foreign market, they must be injured by the effects of their own monopoly. The supply of copper would be diminished more than one-half, and they would therefore lose more by the continuance of the present duties than they would run the risk of losing by the repeal of them. Besides, they ought to recollect, that in this article a new field of supply had recently been opened on the world. Copper was plentiful in many of the States of South America; and if our policy in imposing on it high and prohibitory duties had not prevented it from coming into this country, we should have had a much greater manufacture of copper than we had at present. By prohibiting the importation of copper, other countries had been compelled to undertake the manufacture of it themselves; they had discovered means of rolling and preparing it, and were actually employing our machinery to do that which we should have had an op-

portunity of doing ourselves, had it not been for our impolitic restrictions. A supply of copper was poured into Europe from Chili: of that supply we might have been the masters, if we had not placed on the article such an enormous duty as incapacitated other countries from purchasing it at our hands. A difficulty was always found in reconciling the conflicting interests of the manufacturer and the consumer of an article. He was, however, of opinion, that he should do good to both in reducing the duty on copper from 54*l.* to 27*l.* per ton. That reduction would relieve the evil which pressed at present on the copper-manufacturer of the country, and would be productive of consequences which, he trusted, would enable him, in another session, to propose to the Committee even a still larger reduction. There was another article in which he thought that he might safely propose an alteration of duties. It was the article of spelter, a metal better known by the name of zinc. The duty on the importation of it into this country was 28*l.* per ton. The selling price of it at Hamburgh was 30*l.* per ton, whilst in England it was from 40*l.* to 50*l.* per ton. This article formed a third part of the composition of brass; so that with this duty of 28*l.* per ton on the zinc, and a duty of 54*l.* per ton on the copper which went to its formation, how could they suppose that the English manufacturer could support himself against the competition of the foreign manufacturer? The great occupation of our manufacturers at present was, to furnish patterns for the foreign manufacturers, which they were unable to furnish for themselves. He proposed to reduce the duty on this article full one-half. He believed that the reduction ought to go still further, but he would not press it at present, in consequence of some individuals having capital engaged in the mines of this country, which, however, could not in any respect compete with those of Silesia."

OPENING OYSTERS.

SIR,—Observing, in the Mechanics' Magazine, No. 83, page 418, a quick method of Opening Oysters, which, in some respects, is objectionable, as I have made use of it myself. The objection is, it always pulverizes some portion of the shell, which the knife is likely to carry in; and I have found a large portion of the thick lower shell to break off, and spoil the oyster, after every care. I have adopted another method, where a person is in possession of the mechanical power, thus described:—Take hold of an oyster, placing the thumb on the upper shell and two or three fingers to the lower shell; place the sides of the shells between the cheeks of a strong fixed vice: the screw of the vice acts so regularly that the upper shell is seen to rise sufficiently to get the well-sharpened edge of a dessert knife in, to cut the heart of the oyster from the lower shell: take the oyster out of the vice, and the upper shell is easily forced off. I think a man, with some adroitness, can open a large dishful, to set upon a supper table, in half an hour. I have observed some persons prefer them off the shell, to eating them off a plate, with vinegar and pepper; and I have seen an oyster taken up with a fork, with a beard hanging down like a Jew, the oyster half cut in two, with streaks of black mud on its whiteness. Though this may be called a lazy, slow way of opening them, yet where is the man who objects to a well-cooked dinner or a clean-opened oyster, even if he waited a short time? As I live only a few miles from the eastern coast of Essex, where we have the best, and eat plenty, I would suggest a method of preventing oysters having black streaks. Put a peck of oysters into a large round flat tub, or, what is better, a stone trough, under a pump; plug the stone up; pump six or eight inches of water; make a servant, with a birch broom, brush them for four or five minutes with some force; unplug the stone, and let the dirty water out. With eight or ten strokes of the pump wash them clean, and the shells will not soil a lady's fingers. To keep them—put them, by layers, into a large flat oval yellow dish, sprinkling salt over each layer except the last, then covering them two inches with water, sprinkling over the water a handful of salt, and, at the same time, one or two handsful of oatmeal; set them in a cold cellar, changing the water every *three* days. This is of no use in London, because, perhaps, at the next door lives an oyster-merchant. But what is more agreeable, in the country, when a hungry friend, from a journey, drops in at nine o'clock, than to set before him a dish of fine oysters? It whets his appetite, and becomes an apology for an empty larder.

I am, Sir, yours,

April, 1825. MONTIS.

*** *Notices to numerous Correspondents in our next.*

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

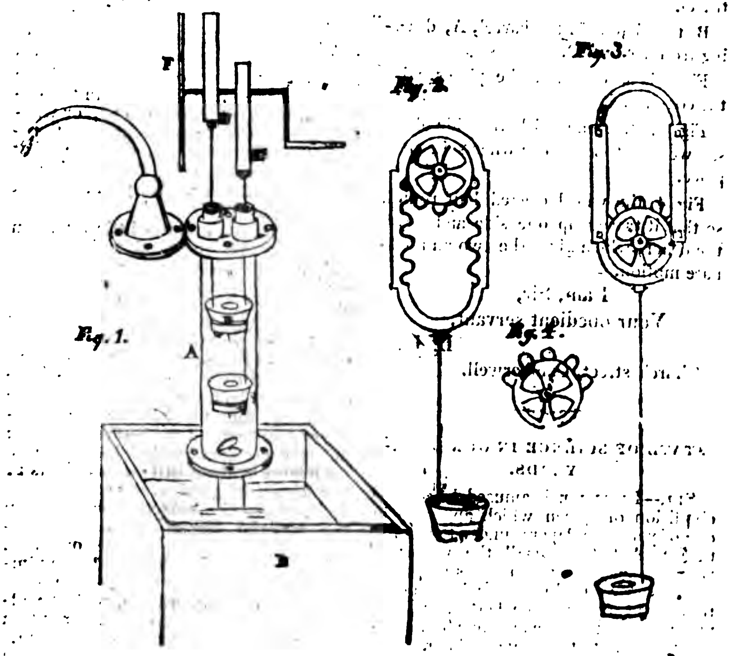
No. 88.] SATURDAY, APRIL 30, 1825. [Price 3*d*.

"The rules which instruct us to produce beauties in any kind of art, must be derived from *the practice* of those who have previously, by the instinct of genius, produced excellent models."—*Ferro*

SINGLE-BARREL HYDRAULIC PUMP,

WITH

DOUBLE ACTION.



SINGLE-BARREL HYDRAULIC PUMP.

SIR,—As an admirer of your interesting publication, and a Member of the Mechanics' Institution, I cannot withhold any suggestion which I think may tend to promote your views. The many excellent articles which appear in your Magazine must greatly add to the cultivation of science, and elucidate much abstruse matter; permit me, therefore, to offer you the above Drawing and Section of a Single-Barrel Hydraulic Pump, with a double action, which is both simple and easy, and may be applicable for many purposes, where a double barrel cannot be conveniently fixed, or for deep wells. It may be worked by a crank or water-wheel, and will keep a continual stream, as the pistons act alternately.

Description.

Fig. 1 represents the pump in full play.

F, the fly-wheel.

EE, the plates in which the cog-wheels travel.

B, the pistons in the barrel, A, drawing from a tank, D.

Fig. 2 is a section of the plates, with the cog-wheel.

Fig. 3, the same, with the side plates screwed on to keep the wheels in their place.

Fig. 4, the wheel cogged half round, so that it travels up one side and down the other, which gives the two an alternate motion.

I am, Sir,
Your obedient servant,
B. H.

Church-street, Camberwell.

STATE OF SCIENCE IN OUR DOCKYARDS.

SIR,—I was much amused by a little ebullition of spleen which appeared in one of your late Papers, under the signature "Anti-Calculus;" the writer of which has been at much pains to prove, that because our ships have been good, they ought never to be better, and appears to think it little less than high treason to attempt at improving them. Science and mathematics, in naval architecture, are to him the Raw-head and Bloody-bones of his maturer years; and the Calculus (oh! poor Calculus!) a phantom dreadful to his imagination. But, amidst all his vituperation of the calculus, I would ask, Does he know what he means? Is he aware in what way it may be applied to the study of naval architecture? and is he aware of the value of this naughty calculus in other sciences? If he be aware—if he do know, I should have expected that he might have been led to indulge the innocent hope, that poor Naval Architecture, too, may be benefited by its almost infinite powers. If he be not aware of these things, it was not quite wise in him to expose himself by this abuse. But I suppose Anti-Calculus was very happy before this horrible calculus was ever heard of in a dock-yard; and subscribing to the poet's maxim, "where ignorance is bliss," &c. he would again be very happy if it should never be heard of more.

The question, however, is of too much importance to be discussed merely with a reference to the opinions and tastes of H. C., or of the class (unhappily a very large one) which he represents, viz.—all those who wish the good old days were never to pass away—those whose interest it was for them to remain—together with those whose yearnings for the benefit of past times are easily transformed by them into fearful anticipations for the future.

This matter is of much higher interest; it is a national question, whether we shall remain the most ignorant of the maritime nations of Europe in the science of most importance to us, or whether we shall make some struggle to redeem our character? Let us see what the Commissioners for the Revision of the Civil Affairs of the Navy, in 1804, said on this subject:—

"In this country too little attention has been paid to naval architecture; and, unfortunately, what was given to it a few years ago seems to have been discontinued, without having yet been turned to much practical use." * * *

"Where we have built exactly after the form of the best of the French ships that have been taken, thus adding our dexterity in building to their knowledge in theory, the ships, it is generally allowed, have proved the best in our navy; but whenever our builders have been so far misled by their little attainments in the science of naval architecture, as to depart from the model before them in any material degree, and attempt improvements, the true principles on which ships ought to be constructed being imperfectly known to them, have been mistaken or counteracted, and the alterations, according to the information given us, have in many cases done harm.

"While, therefore, our rivals in naval power were employing men of the greatest

talents, and most extensive acquirements, to call in the aid of science, we have contented ourselves with groping on in the dark, in quest of such discoveries as chance might bring in our way."

The names attached to this document are, perhaps, nearly of as much weight as that of A. C., even supposing the *real* name itself given.

Let the Commissioners also speak for themselves, as to the qualifications of the Officers of Dockyards formerly, and of their reasons for an alteration of the system:—

"In the whole course we have described, no opportunity will be found of acquiring even the common education given to men of their rank in life; and they rise to the complete direction of the construction of ships, on which the safety of the empire depends, without any care or provision having been taken, on the part of the public, that they should have any instruction in the mathematics, mechanics, or in the science or theory of naval architecture."

After mentioning the way in which apprentices were received in the King's Yards, the Report says—"Those who have since come into our dockyards are, accordingly, found to be almost entirely without education."——"We believe the representation we have given of the education of the shipwrights, as matters are at present carried on, to be correct; it can scarcely be necessary to add, then, that unless the plan of the present system shall be altered, even good working shipwrights will hardly be found in our dockyards; and it would be in vain to expect order or regularity in the conduct of the business, accuracy in the accounts, or professional skill, in those who must, at no great distance of time, come, of course, to be entrusted with the management of every thing respecting the construction of the ships by which this country is to be defended."

After this, it will not, I think, be denied by the most practical men, that something was wanting, when another system was proposed by these statesmen; for it would hardly, I imagine, be deemed prudent by them, that the most important branch of all the practical and theoretical works of this great Government should be ultimately entrusted to persons, for whose introduction into the service not even the qualification of spelling was necessary; and who, during the period alluded to, were often such as to deter the more respectable of the artificers themselves from putting their sons as apprentices. To obviate these difficulties, the Legislature established the School of Naval Architecture; and it will now be worth while to see if this institution has, or has not, made good, as far as could reasonably be expected of it, the intentions of its noble founders. And here it must be highly gratifying to its members, that those whose opinions are most valuable to them, and who have the best means of information, are the best satisfied with their exertions, the most content with their progress. [Vide the notices from time to time of Lord Melville, and Preface to Knowles on Dry Rot.]

But we will meet A. C. on his own ground. It is brought as a proof of failure, that the Regent yacht was not the finest ship of the kind that ever sailed. It is also stated, that this institution has now been established fifteen years, and from the way in which the very candid A. C. has put it, it may be understood that the Regent was the result of fifteen years' study of naval architecture, and the last effort made by the students of this establishment. What is the fact? In the first place, it is scarcely more than fourteen years since the very first student was admitted at Portsmouth, at which time, from the newness of the thing, and the want of some particular patron, no arrangement was made for their instruction or improvement—they had not even a separate place allotted to them for study. Professor Inman (it is now, after his great and, it may be said, successful exertions, no disparagement to say it) had never read a book on naval architecture—knew not even its terms; yet to him was left the whole weight of the establishment. Accordingly, some time was requisite to look for a proper author: there was none in English; the book was to be translated, and the difficulty of translating a technical work, those who have tried it alone can judge. Thus much time was necessarily consumed. Again, the very candid A. C. has spoken of the School of Naval Architecture as entirely theoretical; let him read the course of studies, and he will there see, that one half of the time is devoted to pure manual, *practical* ship-building, beside the time allotted to *laying-off*. In fact, there are but three afternoons in the week appropriated to mathematical study. Now, the Regent yacht was ordered to be built in about four years and a half after the commencement of the establishment—a time when not one of the students, what with the attention to practical shipbuilding, and the necessary preliminary mathematical study, had commenced the study of naval architecture more than a year; and yet A. C. makes it a matter of surprise that she was not perfect. She was, in fact, rather overmasted; but subsequently, in a trial with the Royal George, the masterpiece of yachts, she was found to be scarcely inferior to her. But why has this solitary instance of want of *complete success* been brought forward? Why have the Rose and the Orestes been so entirely forgotten? The former, I believe, will be found to have

been superior to the Martin, the rival vessel; and the Orestes, as far as the trials have yet gone, for which we have the authority of Captain Hayes himself, has lost nothing of the credit of the establishment.

At the Navy Office, in addition to the talents universally acknowledged of Sir Robert Seppings, there is a gentleman of first-rate ability, who has for many years been employed in the constructions made there; and it is not too much to say, that the best English constructions of the day have gone through his hands; yet has the School of Naval Architecture lost any thing by the contact? And is it nothing for an infant establishment, depressed by neglect, awed by the opposition universally given to things new, and having to sustain the weight of all the attacks which old prejudices, old interests, and "old human nature," could bring against it—is it nothing, I ask, to have contended with these master-spirits of the time, and to have come off, not only without dishonour, but with merited praise? It will not—it cannot be denied, that those ships are evidences of the improvement of the School; and if, under such circumstances, so much has been done in so short a time, is it not fair to hope that, when consolidated in its foundations, its patrons determined in their protection, and its members incited by hope and encouragement, naval architecture may yet receive the benefit anticipated by those who projected the establishment?

A. C., however, seems to imagine, that discoveries in naval architecture, confessedly the most difficult and complicated of the arts, are to be obtained as eggs are got—put a cock and hen together, and eggs will be the probable result; so he appears to expect, that put a master and pupil together at naval architecture, and in about the same time (*hey presto!*) our ships ought to sail to the moon. But Dr. Johnson said, a long time ago, "that the expectations of ignorance are indefinite," and every day's experience proves its truth. If Anti-Calculus believes that learning will give genius, he has only fallen into the error of the countryman who expected to read because of his spectacles; but if he does not know that education alone enables its possessor to turn his talents to the best account, he must be more ignorant than he appears to be, or than he even wishes the shipwright to remain.

Anti-Calculus passes a high eulogium on the practical shipwright—I certainly agree with him; perhaps there is not to be found in the service of the state a more valuable class of men. But would they have done less if they had had more power—that additional power which the contemplation of mechanical principles gives ... directing the effort ...

"*even at the impulse of the moment*, and *although employed from six o'clock to six, or even from five to nine?*" How often may the practical man be seen struggling with the ingenious devices which fill his mind, yet unable to give them form or maturity for want of this assistance, of which A. C. is in so much alarm? The merely practical man will ever excel in old and beaten paths; put him in the track where he has been jogging time out of mind, and the most brilliant genius, the highest *calculus*, must hide their diminished heads. But the time when innovation in ship-building was looked upon with sacred horror, when every nail was to be driven in sanctified reverence to former nails, has for some time gone by; the reiterated attacks of Seppings have burst the tenfold chain in which the improvements of our navy, even practically, seemed almost spell-bound; and now, when propositions of every kind are issuing from every quarter, it requires something beyond a knowledge of former rules to decide on what should be received and what rejected, and, at the same time, to carry into effect that which is received with the greatest advantage to the end proposed, and to the public service. Were, indeed, any evidence wanting as to the benefit of the School of Naval Architecture, the impulse which this interesting branch of science has of late received, and which might be proved to have resulted from it, would alone be sufficient. Every publication is teeming with questions on the subject—the spirit of inquiry is afloat, and even this letter of A. C. will add to the flood; proving, too, by the violence of the resistance, the strength of the tide in the opposite direction.

As to the attack on Alpha, that is merely the vehicle by which the School of Naval Architecture was to be brought to account, though there the general candour of A. C. breaks forth. Alpha does not say that "a calculus is now formed and applied by the Academy, by which the sailing and other qualities of a ship may be predicted, previous to her being built;" he only asserts that it is taught there, and speaks of the general utility likely to result from its application to the phenomena of naval architecture. Anti-Calculus also insinuates that French, dancing, and fencing, are among the subjects taught at Portsmouth. He must know but little of the matter, if he be not aware that neither one nor the other have a place in their employment: so far from it, that only a day and a half in the week are employed in theoretical study; and that the remainder is devoted to *practical ship-building* and its dependencies, draughting, laying-off, and drawing. Far is it from them, then, to depreciate the merit of the practical me...

thanic; for it is on the *union* of that and theoretical knowledge that their stand, in the estimation of the Government and their country, must be made. It is true, that in consequence of the peace, they have not been frequently called upon to make the extraordinary exertion quoted by A. C., but never have they been found backward when so required. Still they are not wholly without some claim to the favour and protection of the public, if it were only in consideration of the seven years of hard and laborious study at Portsmouth, to which, in more than one instance, health, if not life, has been the sacrifice: nor does there appear to be any just ground to disturb that zeal, in one of their duties, which in another has led many of these students to restrict themselves to three or four hours rest only for many successive nights.

As to the question respecting "the students being employed in the superintendence of house carpenters and joiners," there can be but one opinion; it is an entire misapplication of the education on which the public money has been expended. It is worse still as it regards the object about which so much is said—the acquisition of practical knowledge, by wholly absorbing their exertions in a different direction. This is knocking a man down with a bludgeon, and then quarrelling with him for not keeping his legs.

There are some other points in A. C.'s letter on which I would wish to offer some remarks; but having already, I fear, exceeded the limits you may be able to afford to this discussion, I shall reserve them for some future occasion.

In conclusion, then, Sir, I should be very sorry if that which I have been led to say, in vindication of this national institution, should be capable of being construed into any thing like disrespect for the talents of those who have gone before; on the contrary, I highly appreciate and respect them: and though alive to the hopes for the future given by the one, I also feel gratitude and veneration for the other; for I, too, though without any exclusive title, am

A SHIPWRIGHT.

SQUARE AND CUBE NUMBERS.

SIR,—I read with much pleasure the communication of your ingenious Correspondent, respecting the production of Square and Cube Numbers by multiplication of others. I have long known that the product of any square number × 4 was equal to the square of double the root, and that a cube number multiplied by 8 gave the same result; but I did not know of any law which governed those results, until I sat down to study the matter of the communication alluded to. I then immediately discovered what I had never met with in any work on the subject (very few, indeed, have fallen in my way), that the following principle exists in the case, viz. the product of any two numbers of the same power will be the power of the product of their roots, from which we derive the following corollary:—The successive product of any number of numbers, of any power, will be the power of the successive product of the roots; for, when each product is obtained, it will amount to the original proposition, viz. a root and its power.

Let 4^2	=	16
8^2	=	64
32		64
		96
32^2	=	1024
6^2	=	36
192		6144
		3072
192^2	=	36,864

Let 2^3	=	8
4^3	=	64
8^3	=	512
6^3	=	216
48		3072
		512
		1024
48^3	=	110,592

It is the same with the biquadrate, and, of course, all the higher powers.

Let 2^4	=	16
4^4	=	256
8		1536
		256
8^4	=	4096

The following numbers are both squares and cubes, viz.

	Square root.	Cube root.
1	1	1
64	8	4
729	27	9
4,096	64	16
15,625	125	25
46,656	216	36
117,649	343	49
262,144	512	64
531,441	729	81
1,000,000	1000	100

Our cube roots evidently exhibit the regular series of the perfect square numbers, and we perceive this law to exist: The cubes of the perfect square numbers are also squares, and their square roots are formed by the product of the original square number multiplied by its root, and, consequently, they must be cubes; and, on reference to our column of square roots, we find it exhibits the regular series of perfect cube numbers, and the column of squares and cubes is evidently the regular series of the sixth power, or square cubed or cube squared.

The consideration of such beautiful properties naturally brings to our recollection the attributes of the great Geometer who formed them—How applicable, then, the term Omniscience!

I remain, Sir,
Your most obedient servant,
Cork. RICHARD DOWDEN.

BAKING MACHINERY WANTED.

SIR,—Among the various improvements which modern times have produced, and to many of which your very useful Magazine has given publicity, it is rather extraordinary that the slovenly and highly objectionable mode of manufacturing bread, both in large and small bakeries, should hitherto be so entirely overlooked as not to call forth one solitary suggestion towards an improvement. The great desideratum is to preclude the necessity of workmen using their naked hands and arms, by total immersion of them in the *material*, in the process of the work, which, under a warm temperature, and without the most particular attention to cleanliness, must, on reflection, suggest ideas not very encouraging to the general use of that article. I would, therefore, beg leave to call the attention of some of your ingenious Correspondents to this important subject, not doubting but that this hint will induce it to be eagerly taken up, when its importance to the public is duly considered. Answers to the following questions may, perhaps, lead to the means by which the object sought may be accomplished:—

1st. What sort of machinery could be best applied to the purpose of mixing (primarily) the spunge, and, thereafter, the spunge and salt liquor, in bakeries where the business is done on a large scale, and now performed by total immersion of the workman's hands and arms?

2nd. In such case what must be the form of the kneading-troughs?

3rd. What description of tools or apparatus could be most usefully applied to the mixing and incorporating the material, viz. the flour and liquor, and afterwards kneading it, without bringing the naked hands and arms of the workmen in contact therewith?

4th. What description of apparatus could be effectually applied to the kneading and pressing the dough, after being boarded for scaling, &c.?

5th. What means could be devised for shifting it from the troughs, and from one place to another of the bakehouse, without having recourse to the present mode of taking it up in the workman's arms?

These inquiries, if satisfactorily answered, must accomplish three important objects—first, cleanliness and dispatch in the manufacture of that staff of life—bread; secondly, giving to the workmen a neat, clean, and workman-like appearance, instead of a filthy and slovenly one; thirdly, the removal of the cause of that infirmity or defect in the limbs with which working bakers are sometimes afflicted, and which has given rise to the term *baker-legged*.

Next, in respect of ovens.

What are the means by which the expansive force of the flame issuing from the furnace may be increased, and its progress delayed from the

suction-flue, so as to make it spend all its power on the oven, and at the same time diminish the expenditure of fuel? And by what means can this be best effected, with a proper regard to cleanliness, ventilation, and temperature?

I have no doubt but some of your ingenious Correspondents will endeavour to render to the public that extensive service which a satisfactory answer to those questions must infallibly produce.

I am, Sir,

Your obedient servant,

A. B. C.

PIN-GRINDERS SAFETY APPARATUS.

Sir,—Your Magazine being published for the benefit of Mechanics, I beg to point out to you one class deserving the greatest commiseration, and who, through the ingenuity of some of your numerous Correspondents, will, I trust, shortly experience the relief which ought to be afforded to them. I allude to those men employed in grinding the points of pins. More wretched objects are no where to be found, and no men would voluntarily endure the sufferings they undergo, together with the forfeiture of their lives in a few years, did not good pay bribe them to the sacrifice. The evil arises from the quantity of brass dust which they inhale into the lungs, which brings on consumption, and which, by getting into the eyes likewise, brings on blindness. Some simple contrivance would obviate all this misery. A frame might be suspended to the ceiling, to be raised or lowered as required, the upper part of which should have glass in front, to see through; the lower part should be so managed as to fit closely to the nose and mouth, from which two tubes should be conducted to some little distance behind; one to convey fresh air, the other to carry off the foul air of the breath. The man's head should be placed in this frame when at work, and were it padded so as to fit closely round the neck, so that he could breathe through the tube only, no dust could be taken up by the breath, nor could it reach the eyes. As these men generally work before a window, the tubes may be carried through that window.

I merely give my idea of a plan, which, I hope, some able head and hand will bring to perfection and general use.

I am, Sir, &c.

A Friend to the Distressed.

[A Correspondent, in a former Number (page 117, vol. ii.), recommends that a sponge mask should be used for the same purpose, but the present contrivance seems better adapted for constant use.—Edit.]

CURE FOR TOOTHACHE.

Sir,—No fact which has a tendency to relieve bodily suffering, is unworthy a place in the Mechanics' Magazine.

I have lately been tormented with toothache, or, rather, rheumatic affection of the upper and lower jaw, and have found the best remedy to be the common spirits of camphor, which is a solution of that substance in rectified spirit of wine. I apply it either with the end of my finger, very frequently, on each side of the gums, or else use a brush which has a sponge on one end. I find it decidedly better than laudanum, or any hot tincture, both of which, though they relieve at the time, increase the spasm afterwards. It is well for persons having an attack of the toothache to take five grains of blue pill at night, and a strong black jack (senna and salts) in the morning, or an emetic at night. Experience has shown me the importance of this.

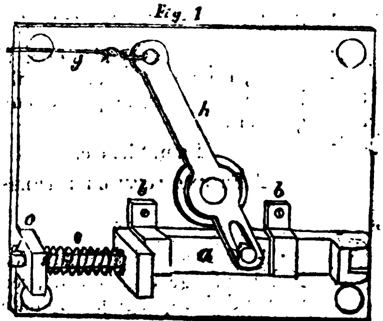
I am, Sir,

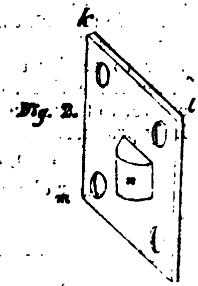
Your obedient servant,

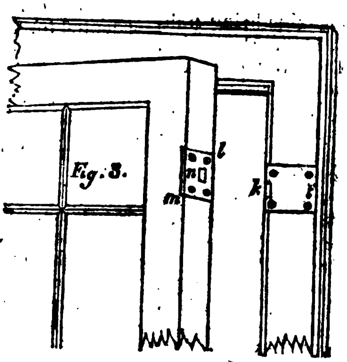
Boswell Robert Gregory

Mill-hill, April 2, 1825.

SHOP-DOOR ALARUM-BOLT.







Sir,—Above are the drawings of a simple contrivance for attaching a bell to a shop-door, and which may be called an Alarum-Bolt. It is a custom with many of the middle class of shopkeepers to affix a bell either to the door-frame, so that the door, in opening, shall strike the clapper, or to hang it to the door itself. The first of these methods I know, by experience, to be very far from secure, and I should imagine the other to be little less so; but, by the application of such a bolt as the above, all danger would be avoided. The bolt is applicable to any kind of door, and will also be useful for a night-alarum.

Description.

Fig. 1 represents a plate of iron, having the piece, *c*, turned up on one side; *a* is the bolt, having the end rounded, and sliding under the pieces, *b b*; *d* is a pin fixed in the end of the bolt, and sliding through *e*; *e* is a spiral spring, sufficiently strong to keep the bolt against the piece, *b*, but not to offer too great a resistance to the door; *h* is a lever moving on a joint, the short end of which has a slit to receive a pin; the other has fastened to it the wire, *g*, communicating with the bell (which may be placed in any convenient situation). There is a notch in the right side of the plate, to allow the lump, *n* (Fig. 2), to pass.

The plate is to be let into the door-post, as at *i k* (Fig. 3).

Fig. 2—*l m* is another plate of iron, to be let into the front edge of the door, as at *l m* (Fig. 3), having a projecting tongue, *n*, near the side.

The action of the bolt may be described thus:—The door, in opening, forces the bolt back, and, of course, moves the long arm of the lever the contrary way, and immediately on the tongue clearing the bolt, the spring returns it to its original position.

I remain, Sir,
Yours, respectfully,
F. H.

Percy-street, St. Pancras.

CARMARTHEN GUNS.

Fig. 1

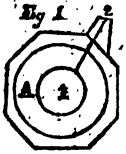


Fig. 2

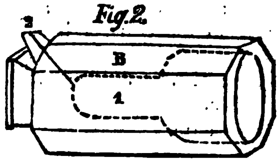


Fig. 3

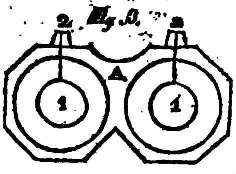


Fig. 4.

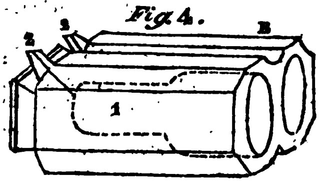
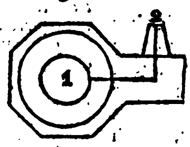


Fig. 5



SIR, As several of your Correspondents are disputing the merits of the different gun-locks in use, I beg leave to describe the lock that I have had in use, for the last two years (made by Mr. Thomas Lewis, of Carmarthen). It is a common detonator, with copper caps: the difference is in the plug or touch-hole, which is placed as far back and as high up as it can be placed without destroying the sight along the barrel of the gun. I have also seen a double-barrel gun (J. Evans, maker, Carmarthen), fitted elegantly for caps or patches, with the plugs or touch-hole on the tops of the barrels, the owner of which told me that it answered his utmost expectation. Its advantages are these:—You avoid the angle which the fire has to pass from the cap or patches, in the old locks, to the chamber of the barrel, as it now goes in a direct line to the back of the chamber: it never misses fire, for the strength of the detonating fire forces all obstruction in the touch-hole before it into the chamber, which it could not do before, owing to the angle in the old locks.

I can convert my lock to a flint-lock at pleasure (when I cannot get any caps), by taking out a screw or pin from the common touch-hole and placing it into the plug, and screwing a cap on the plug similar to the caps that are on the screws of ramrods, changing the cocks and putting on the hammer.

I have sent rough plans of the difference between the plugs in my locks and the plugs in the common locks, which I hope you will be able to understand and improve on, for the benefit of your readers.

I am, Sir,

Your humble servant,

W. R. D.

January 31st, 1825.
Carmarthen.

Description of the Figures.

A (fig. 1) is an end view of the improved single-barrel gun.

B (fig. 2), a side view of the same.

1. Chamber of the gun.

2. Plug or touch-hole. The line from the plug to the chamber is the touch-hole.

A (fig. 3), end view of the improved double-barrel gun.

B (fig. 4), side ditto.

1. Chambers.

2. Plugs or touch-hole. The lines from 2 to 1 show the direction the fire takes in going from the caps to the chamber of the gun.

Fig. 5 is an end view of the common detonating barrel, with plug, &c. fixed, showing the angle the fire has to make in going from the cap to the chamber of the gun to explode the powder.

HIGH PRICE OF BEER.

[Being desirous only of eliciting the truth on this, as on every other subject treated of in our pages, and convinced that this cannot be better promoted than by the fair conflict of argument, we insert a letter, which takes a very different view of the Tax on Beer from that of two writers in a former Number, and to which last we ourselves incline. Our new Correspondent thinks that we have rather diverged towards politics in touching at all on taxation; but if he will reflect, that beer may be considered as the oil which keeps the animal machine from rusting and going to decay, he will perceive that we have still had *an eye to mechanics* in giving a place to this discussion. With respect to his arguments against the removal of the tax on this essential commodity (to which our friend Mark Anvil, or the "Steam Engine Workman," will probably consider it his duty to reply at length), we shall content ourselves with remarking, that even admitting all he contends for, he has not advanced one reason *in favour of the tax*. It may be true, that the brewers are great monopolists and great extortioners; it may be true—it is, indeed, quite obvious—that persons brewing on a large scale can brew at a far cheaper rate than a person who brews for himself and family alone; it may be true, also, that the beer supplied by the great brewers is sad trash. But what then? Does it follow that, for all or any of these causes, the poor hard-working mechanic should pay ten shillings of duty on his barrel of beer, and the richest nobleman in the land pay nothing?—EDIT.]

SIR,—I have read with pleasure and with profit your useful publication from its first commencement; it has kept to its text—the dissemination of scientific knowledge amongst us—and long, Sir, may it pursue the same path. Politics, or political economy, is not its province; and, to your honour, you have steered your little bark clear of these quicksands. I was almost sorry to see, as I thought, a departure from this course, by the introduction of the two articles in your 84th Number on the "High Price of Beer." Both of these Correspondents are in error, when they attribute *injustice* to the tax on beer, and wish it transferred wholly to malt; it would, on the contrary, be the most disgraceful act of injustice ever inflicted on industry, economy, and prudence. What, Sir! take it from the shoulders of an overgrown monopoly—from those who have for years been pulling down their barns to build bigger?—Take it from those whose beer-manufactories, both in the country and particularly in London, have risen up till they resemble towns and villages?—Take it from those who have not hesitated to give thousands—nay, I believe, in some cases, almost tens of thousands—for a shop (*i. e.* a public-house, "those sties which law has licensed"), in which they might retail out their delicious beverage?—Take the tax from them, and impose it on whom?—Why, not on those represented by your Correspondents. It is an unfair view of the matter to say that it is the persons who can afford to keep servants, &c. &c. I must tell Mark Anvil (but, Sir, there are brewers as well as blacksmiths living in Thames-street) he is mistaken in his man. It is a "bad heat" he has taken this time; for, Sir, the large majority of those who brew, and who drink home-brewed beer, are the industrious, the prudent tradesmen, who prefer their homes, with a wholesome beverage, to that bane of society, the worst evil to mechanics that exists, the public-house. The large majority of those who brew, and who drink home-brewed beer, consist of the most valuable part of society, whether they be found amongst our jour-

neymen mechanics or their masters, our country tradesmen or their servants; and the individuals whom Mark Anvil designates under the title of "the wealthy man, with his capacious cellars," &c. are comparatively few. Even the latter, Sir, pay more revenue than the man who drinks brewers' beer in or from a public-house. And here it is I take my stand—here I and my brother blacksmith (if he really be a son of Vulcan) are at issue. I deny, Sir, his position. I assert, that the brewer of his own beer pays from 50 to 75 per cent. more tax on every shilling's worth of beer he drinks, than is paid by the man who drinks a shilling's worth of the compounds sold in our public-houses. Let your Correspondents, Sir, (if they are in the secret), tell us, *bona fide*, the quantity of malt and hops used by our public brewers, compared with the brewer of his own beer, each having his beer of equal strength; meaning by strength the same inebriating power. Let him tell us the difference of price at which the public brewer buys his hops (the *quassia* we will not ask for), compared with the brewer of his own beer. Let him tell us the difference of price paid by the public brewer for his malt (or rather, I believe, I should have said, his barley); for, Sir, the brewer of his own beer (and let this never be forgotten on this subject) helps to support a respectable, honourable, and industrious class of men, the maltsters, who, I believe, would come short if they depended on the public brewers as customers. Let him tell us the immense advantage—and, Sir, it is so immense, that Mr. Drury has said, that to brew less than 30,000 barrels annually (I speak from memory, not having his book at hand to refer to), is to brew at a considerable disadvantage—the public brewer has over the brewer of his own beer, in the increased quantity (from 25 to 50 per cent. or more) of saccharine juice he obtains. Let him tell us the advantages of the conveniences, and the scientific method he can make use of. In short Sir, the comparison, in every particular, is so decidedly against the brewer of his own beer, that it is the satisfaction he feels in knowing WHAT he drinks—it is the persuasion that the public-house beer is so different in colour, in taste, in its inebriating quality, to that which he obtains by his own brewing, and not the cheapness or difference in price, which are the most powerful considerations with every brewer of his own beer, when he prefers it to the compounds to be had at a public-house, or brewer's shop. As to a working man not being able to brew his own beer, I know, Sir, many that do so; and I can see nothing to prevent others following the example but want of will. I know that they cannot make beer from malt and hops alone which will so soon inebriate as the stuff they buy at the public-house; but I know also that they *can* brew beer as nutritious—beer which will sustain animal strength under fatigue much longer—beer which will not add thirst to thirst—beer which will not inebriate, and that at a *cheaper rate* than they can purchase public-house beer. It is but too true, I fear, that the taste of the mechanic has become so vitiated, that he can no longer relish the taste of good sound beer, having only the flavour of malt and hops. No, Sir, his dish has been high seasoned so long, that his relish for malt liquor is gone; he must have the same high-seasoned beverage as before, however pernicious, or else it has, in his conceit, no strength in it.

Sir, these are what I call commonplace truths, and I hope they wil be allowed a place in your Magazine, to counteract the tendency of your Correspondents to bring about one of the most flagrant outrages on an Englishman's property—a tax which shall tax that man who is the most industrious, economical, prudent, and striving, to relieve the public brewer. I take my stand upon the matter of fact, and I assert, that the man who drinks public-house beer pays *less revenue out of his shilling* than I do, who brew my own beer. I say, Sir, he ought to be supplied with beer from the public brewer, having the same nutritious qualities, at 50 per cent. less than I can brew it, including duty. But I again assert, without the fear of successful contradiction, that the public brewers have vitiated the taste of people in general, so that they do not—they cannot relish a plain, homely liquor; they must have it spiced with the coriander, the cocculus indicus, the quassia, &c. &c. and thus the good plain, pale, sound, homely, home-brewed will not go down.

I have not gone into the morality of this question—I content myself with calling for the data. I have mentioned, to disprove the assertion of your Correspondents, that the brewer of his own beer pays less revenue than the man who drinks the public-house beer. I am content, Sir, to drink my own beer, brewed by my own hands, at times taken from the active exertions of the day; but, Sir, am I to be consigned over to the tender mercies of a publican and public brewer? Am I and a thousand more, who, by our own industry and the industry of our wives, brew our own beer, to be loaded with taxes, taken from the shoulders of the public brewer, and, as your Correspondents would have it, to be obliged to buy of the brewer a compound which, to say the least, my clean beer has taught me to disrelish? *Our* industry is to be loaded to add to the profits of overgrown wealth—*our* appetites are to be vitiated by a compound as much like home-

brewed beer as laudanum is like Madeira. It would be very easy to prove, from your 'Correspondents' quarter of malt, 8lb. of hops, &c. &c. the fallacy of his complaint, but I fear I have already exhausted your patience.

Your obedient servant,

A REAL BLACKSMITH.

HOW TO PREVENT STOVE-PLATES FROM BREAKING.

SIR,—In my walks through the metropolis, I happened to cast my eye upon a very antiquated moving grate, which perplexed me for a considerable time, endeavouring to unravel the mystery; for I apprehend a mystery is fudge as long as it is unintelligible, and then it is no mystery. The mystery in question is, the metal back of the grate being perforated all over with holes, about three-quarters of an inch diameter each. The broker being applied to for an explanation, supposed the object was to diffuse heat in that direction, should the grate be drawn into the middle of the room—"And with the heat," rejoined I, "much dirt and smoke."

Now, Sir, the *éclaircissement* is this—the holes permit the back to expand when hot, and thereby prevent its breaking. The practice, though obsolete, is worthy of being revived.

I am, Sir,

Your obedient servant,

T. HARTSHORNE.

INSTANCE OF EXTRAORDINARY VISION.

SIR,—In the Isle of France, during the last war, there resided a man who was in the pay of the Emperor Napoleon, and whose office consisted in informing the heads of the department of the approach of vessels to the island. The most powerful telescopes could afford no assistance whatever, compared to what was obtained in this respect by this man's naked eye. He mentioned, once, the arrival of a fleet, and the number of the ships. They kept in the same station for many days, until joined by a squadron of ships, when they bent their course for the island. On their arrival there they answered precisely to the man's previous description. This he could at all times do; yet, stranger still, he always, on those occasions, looked downwards to a surface of water. We know that, in peculiar states of the atmosphere, the air serves the purpose of a reflecting mirror;—such were the instances of Captain Scoresby's ship, seen in the clouds; the village of Great Paxton, in the air; and a city in Switzerland, as if on the surface of a distant lake, lofty mountains lying between. Such phenomena frequently occur; but that the Frenchman should be able, at all times, no matter what the state of the atmosphere, was to penetrate so far into the depths of space, is a fact, I fear, beyond the power of human nature to account for.

I am, Sir,

Your obedient servant,

SALOPY THAMES.

CALCULATING BLIND BOY.

SIR,—I have a young friend to whom I am much attached; he is entirely destitute of sight, and has been so from his infancy. When we consider the accurate calculations he has made, we are struck with astonishment. Should you deem the following production of his worthy of a place in your very valuable Miscellany, its insertion will be an inducement to send you some more of his performances, which are equally surprising. He is a native of Macclesfield, in Cheshire. At the time when he communicated the following arithmetical results to me, he was learning music at the academy of Mr. B., of Manchester. He makes his calculations by *feeling*. These productions evince him to be possessed of great mental powers, although entirely deprived of that celestial light which gives whiteness to the lily, and paints the flowers of the valley. His knowledge in the sciences of algebra and astronomy, particularly the latter, is extensive. He answered the first mathematical question proposed in the Ladies' Diary for 1823, and was congratulated by the Editor of that respectable work for the talent which he displayed. He calculated to a surprising degree of exactness, for the meridian of Macclesfield, the great total lunar eclipse which happened on Sunday evening, January 26th,

1823. He made use of the tables of Dr. Brewster, who has much improved Fergusón's Astronomy.

I am, Sir,

On the behalf of my much respected and esteemed Friend, yours, &c.

JOSEPH HALL.

Harpurhey, March 5, 1825.

If 99 stones were placed in a straight line, the first one yard from a basket, the second two yards, the third three yards, &c. the person who gathers up these 99 stones singly, returning with each to the basket to put it in, would travel no more than five miles and 1100 yards; but if we suppose the first stone to be placed one yard from the basket, the second two yards, the third four yards, &c. doubling the distance every time, the person who undertakes to perform the task in like manner, must travel the enormous distance of 720,256022,856048,523677,672275 miles, 1375 yards. Now, let us admit a body to move uniformly with the amazing velocity of light, which is 95,000,000 miles in seven minutes and a half, it would require 108,111486,793614 years to complete the above distance! And this last number is not less than 18563,098693 times the number of years since the creation of the world to the present time, which, according to chronologers, is 5824 years. Such and so very astonishing is the property of numbers in geometrical progression!

COMBINATION LAWS.

(Concluded from Number 85, page 12.)

Mr. HUME (who may be regarded as the *Parliamentary* father of the Act of Repeal), while he admitted that the workmen had very much misconducted themselves, contended that there had been, on fomer occasions, combinations of a much more formidable nature than any of which Mr. Huskisson now complained; and that, since the repeal, the masters have been quite as much to blame as the men. For example, in Manchester, if, from any cause, a body of spinners refuse to work under a particular master, their names are sent abroad in a circular, to prevent their obtaining employment elsewhere. Was not this an odious combination? Of such proceedings he could not approve, whether they were adopted by masters or by men. In his opinion, both sides carried their measures far beyond the point to which they should restrict themselves—*far beyond what he hoped they would have done when the Combination Laws were abolished.* No person could condemn more than he did all threats and intimidation, and any fair and equitable measure to put an end to every thing of the kind should have his cordial support.

Mr. Secretary PEEL did not wish to argue the point with whom the blame chiefly lay; he did not wish to establish the masters against the men, or the men against the masters. What he wished, for was to have a rational system of legislation. If the masters behaved ill, let there be a law which should apply to them; and if the men conducted themselves improperly, let them be amenable to some restrictive statute. In short, let the legislature adopt some established principle of law, on which the parties interested might safely proceed. They ought to point out the dangerous effects of conspiracy; they ought to show the consequences which the continuance of such an evil must have on the interests of those who were most forward in support of the system. Such an exposition would, he conceived, have a strong effect on the minds of those deluded men, and would, it was to be hoped, put a stop to a course of proceeding which struck at the root of all freedom of trade. It appeared from the evidence of a gentleman who had been examined before the Committee, that in the course of the last three years no less than ten lives were lost in Dublin, in consequence of transactions connected with the combination of tradesmen; and not a single person concerned in those murders had been brought to justice. It really appeared that there must be an exemption from the bonds of civilized society, when ten innocent persons lost their lives, and no one was prosecuted in consequence. This state of things was chiefly kept up by a set of mischievous demagogues, whose machinations ought to be promptly repressed. It should be shown to the workmen, that the present system was decidedly against their interests; and some law, the provisions of which he would not anticipate, ought to be devised, in order to provide an effectual remedy against the mischiefs, which were at present only in progress; but which, if suffered to arrive at maturity, would produce more disastrous effects than any he had witnessed since he entered into public life.

Mr. HUDSON GURNEY remarked, that whatever might be the evils of the existing state of things, they could not be said to have arisen from the repeal; for the fact was, that so far from the old laws having any tendency to prevent combinations, they in reality aggravated them greatly.

Mr. C. GRANT said, that, as one of the Committee whose labours led to the Act of Repeal, he must express his deep regret that those persons, whose interests that Committee had endeavoured to serve, had abused the kindness which had been extended to them.—(Hear.)—The House

could not consent to allow the existence of the vicious and abominable abuse which had been for some time in progress. Every thing should be done to put an end to it; and he, for one, would gladly coincide in any measure which seemed likely to effect that object.

Sir M. W. RIDLEY, Mr. TRANT, Mr. KENNEDY, and Mr. LAMBTON, also spoke in favour of the necessity of a revision of the existing law.

Mr. HUSKISSON, in explanation, admitted that the old Combination Laws were faulty, but contended that he had on this occasion only described those evils which had grown out of the law as it at present stood. The 10th Resolution of the late Committee was, he conceived, a very proper one, namely, "that it was absolutely necessary, on removing the Combination Laws, that measures should be taken to prevent the workmen from having recourse to threats, intimidation, or other improper means, for the purpose of interfering with perfect freedom of trade, or of compelling masters from the employment of their capital in any way they thought best." But it appeared to him, that the Act of Parliament executed very imperfectly the object to which that resolution referred. Great misconception had gone abroad with respect to the Act, and that misconception had created very prejudicial effects in some parts of the country, where the law, instead of producing the advantages which were expected, had really been the cause of mischief. He had no intention, however, to visit any class with severity or punishment. He was not going to propose new penal laws. What he wished was, to draw the attention of the Committee to those laws which regulated the relation between masters and workmen. He was anxious to save, from the consequences of their own delusion, even those who had acted a culpable and improper part. It was really as the friend, not as the enemy, of the workmen as well as of the masters, that he proposed this inquiry. He considered this as a question entirely disconnected with party feeling—as one with which the best interests of the country were intimately connected; and he thought those interests would be placed on a surer and better footing, if the existing law were revised and altered.

The motion was then agreed to (not a single Member being found to oppose the necessity of the measure), and a Committee appointed in conformity therewith, which has since been actively engaged in the examination of evidence on the subject.

In this state we may at present safely leave the matter; nor do we think our friends among the working classes have any occasion to be under the smallest apprehension as to the issue. An idea, we know, has gone abroad, that the object of this new Committee is to bring about a restoration of the old Combination Laws; but it must be manifest, from all that passed in the House on the appointment of that Committee, that nothing is more foreign to the intentions of those Members who are likely to have the greatest influence on the ultimate determination of the question. The hardship and injustice attendant on the former state of things are admitted; and all that is now sought for is to find a better remedy for these than was provided by the late Act of Repeal.

KING CHARLES'S PUZZLE.

SIR,—In reply to a question on Motion, proposed in your very edifying Magazine a few weeks past, the writer alludes, in page 426, vol. III., to a question proposed to King Charles; namely, Whether a vessel of water would not weigh a pound heavier, for having a live fish, which weighed a pound out of water, put into it? I believe it was answered by some, that the vessel of water would not be a pound heavier, while others said that it would; to which last opinion the King inclined. Now, Sir, I frankly confess (pardon the temerity) I differ from his Majesty (whose memory God bless). I really do imagine that, while it is above the bottom, and while the fish is in motion, that is, swimming about, no matter in what direction, it does not communicate a pound in weight to the scale which holds the vessel, water, and fish. Even if weight were an innate quality of matter, it may be conceived possible for a body to press a scale less than its full weight, and even not at all. Mere pressure of the hand on an empty scale will lift and balance a weight in the opposite scale; and as the pressure is lessened, that scale bears less against the weight-scale. In like manner, if a ten-pound weight could buoy itself up, less than ten pounds would balance it; and could it quit the scale and ascend of itself, the instant before quitting it, and although in close contact with it, the same ten-pound weight would not balance or lift again the opposite scale. The fish buoys itself, the water does not, otherwise it could never descend; and in proportion as the self-buoyant power is exerted, so much weight or pressure is taken off the scale. That fish

are furnished with an internal power of this nature, is evident from the velocity of their motion, which far exceeds what might be expected from the feeble exertion of their diminutive external members.

I am, Sir, yours, &c.

T. H.

ARE WE WARMER ASLEEP THAN AWAKE?

SIR,—I do not now address you in order to show, upon natural principles, why we are warmer asleep than awake, but to ask of Caloric (p. 397, vol. III.) *how* he proves that we are warmer asleep than awake? I ask him, did he ever *feel* it in his sleep? When he has thus settled what I now consider to be the first step of the question, I will leave to abler heads than mine the task of accounting for it.

I will, however, with your permission, state the grounds upon which I feel myself authorised to differ from Caloric, when he supposes we are warmest when sleeping. I have been obliged to sit up lately several times in my clothes all night, on a chair or a sofa, and when I awoke, I found myself colder than when I lay down, or rather when I began to sleep. And how is it, moreover, that in severe winters we have heard of watchmen being frozen to death when sleeping in their boxes; whereas, according to Caloric's theory, it would make them all the warmer? Again, why is it, that when we wish to sleep (if we are not in bed), that we wrap ourselves well up, in order to *keep ourselves warm?* This is a common practice, and is much better known than the last sentence in Caloric's note. I do not conceive that being in bed makes any difference with respect to the main question; but if Caloric has been confounding laying in bed and being asleep, the mistake will be immediately visible, for why we are warmest in bed requires no explanation.

I remain, Sir,

Your obedient servant,

T. M. B.

EXTINGUISHING FIRE AT SEA.

SIR,—I am much surprised that no one of your numerous readers (many of them men of great abilities, and some your constant Correspondents) have not noticed the dreadful accident of the burning of the Kent East Indiaman, with a view to a prevention of similar accidents. I may say, I have waited in expectation of some communication on the subject with considerable anxiety; and a letter from "Omega," in your last week's Magazine, has forcibly impressed on my mind the necessity of some method for extinguishing a fire of that description: I will, therefore, take the liberty of making a few observations on the subject.

I should presume, in the first instance, that the usual place of stowage for spirits is, in such ships, in the hold—consequently below the level of the sea; which presumption on my part is somewhat strengthened by a light being necessary to go to the place. I propose, therefore, that a *pipe or pipes* should be introduced (just below the water-mark) from stem to stern, at each end of which should be sluices, working either with elevating screws or racks, which should be so applied as to be got at on deck, and, of course, always kept clear. Supposing a vessel so constructed should be on fire below, on opening the sluice, the lower part of the vessel would immediately be completely wetted; and the force of the water thrown would be materially increased by putting her before the wind, when, I should think, her velocity acting against the sea, would cause the water to rush with considerable force into the pipes. Such an apparatus would act somewhat on the principle of Montgolfier's water-ram, with this difference, that in the one the water has the velocity—in the other, the pipes.

The reason of "Omega's" letter impressing the subject on my mind, is simply, that the science displayed by our naval architects in adding to the sailing, &c. of our vessels, should be also displayed in securing them when built.

I am, Sir, yours, &c.

A. L.

INQUIRIES.

NO. 116.—CONSTRUCTION OF CHIMNEYS.

SIR,—Since your useful Miscellany holds in requisition the skill and experience of scientific and practical men of all descriptions, perhaps some one of those who are skilled in architecture will indulge the writer with a description of the construction and dimensions of a chimney best calculated to prevent annoyance by smoke. Doubtless many things contribute to produce this inconvenience, such as cross-openings into rooms, contiguous lofty buildings, hills, &c.; yet there must be some general dimensions and form of chimneys more favourable

to the ascent and escape of smoke than others.

The case more especially under the writer's notice at present is one of a house of two stories, situate on the west side of a slope, which commences about a hundred yards off, the summit of which is about three hundred yards from the building, and probably twice its height. The inconvenience chiefly occurs with a south south-east wind.

I am, Sir, yours, &c.

J. T.

NO. 117.—STEAMING SILK.

Sir,—At Macclesfield the silk-weavers steam their pieces, which gives beauty and firmness to the work. The process is very little known in Spitalfields, and if any of your Correspondents would publish an account of it in your valuable Magazine, it would be highly serviceable to many of your Spitalfields subscribers.

I am, Sir, yours, &c.

A. B.

NO. 118.—TINNING IRON.

Sir,—I want to tin a bar of iron *at the end only*, and, that it may take the tin, I rub the end of it with sal-ammoniac, which *quickly corrodes* the iron *just above where the tin ends.* Can any of your intelligent Correspondents inform me what to use that will *not so corrode the iron?*

I am, Sir, yours truly,

B——.

NO. 119.—EFFECT OF THE LENGTH OF CONNECTING RODS IN STEAM-ENGINES.

Sir,—One of your readers will feel highly obliged by your insertion of the following query in the Mechanics' Magazine, viz.—

Whether in an engine of such construction where the crank is made to work beneath the cylinder, the power is diminished by reducing the length of the connecting rod: thus, for instance, in a *blast* engine, the piston of which makes a six-fee stroke, and consequently the crank will be three feet long, will there be required a greater degree of power to work it with a connecting rod of five feet, than with one of eight feet in length?

An early answer, with a proof, or reason, and explanation, in as simple and comprehensive a manner as possible, will be thankfully received by,

Sir, your obedient servant,

A. B.

CORRESPONDENCE.

Communications have been received from J. C.—Minor—P. S.—A Shipwright—A. P.—M. R.—A Young Mechanic—Mr. Dowden—A Student in Architecture—Mr. Cleland—An Amateur—Philo—Niho Manroob—X. B.—A Young Printer—G.W.—William Rogers—D.—A Young Engineer—T. J. Simpson—A Caulker—Technos—J. Scott—F. Handsaw—Incredulous—R. M.—Gimlet—A. Newton—B. Mercer—A Subscriber at Redruth.

An "Old Flask" has been received. We have tried the experiment, and, with us, nothing of the kind takes place.

In consequence of greater time being required by our Engraver than we anticipated, for the execution of the Portrait of Mr. Brougham (taken, by permission, from an original Painting), the publication of the Supplement to the Third Volume, which should have appeared with this Number, is necessarily deferred.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 89.] SATURDAY, MAY 6, 1825. [Price 3d.

PLAN OF A STEAM-BOAT, WITH ONE WHEEL IN ITS CENTRE,

PROPER FOR CANAL, RIVER, OR SEA NAVIGATION.

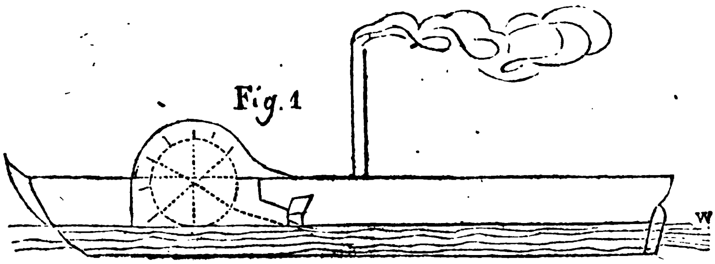


Fig. 1

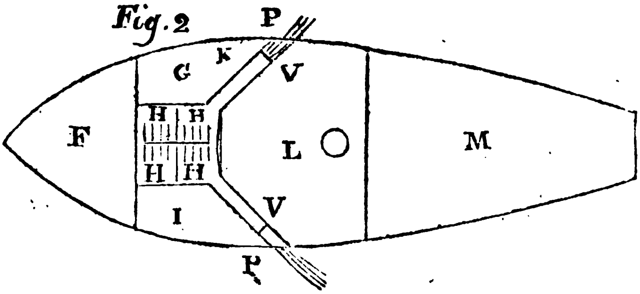


Fig. 2

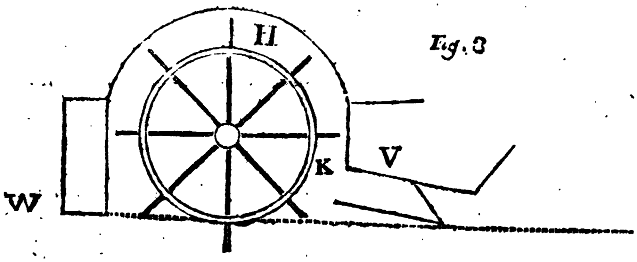


Fig. 3

PLAN OF A STEAM-BOAT, WITH ONE WHEEL IN ITS CENTRE, PROPER FOR CANAL, RIVER, OR SEA NAVIGATION.

SIR,—As one of the most desirable improvements in Steam Boats is the dispensing altogether with the side-paddles, thereby increasing their velocity, by causing them to hold less wind, I am induced to send you a few lines upon the subject; and should you think proper to insert them, the idea may possibly be improved upon by the scientific, and ultimately produce the desired effect.

By this plan, when the water rises above its level in the paddle-box (HHHH, fig. 2), it escapes by its own weight through the channels, PP, each of which is terminated by a port-hole, a little above the water-line in the midships. The channels are also furnished with valves (VV, fig. 2), that are self-acting, and permit the escape of the internal, and, at the same time, prevent the ingress of the external fluid. These ports being closed, either in foul weather, or in consequence of any accident occurring to the machinery, instantly convert the steam into a perfect sailing vessel. Of course, it must be understood that this boat is propelled by a single wheel in its centre; and I find, by experiments on a minor scale, that its steerage is equally unaffected as in boats of the present build.

The London Engineer was built nearly upon this principle, and failed, only because the paddle-box filled with the back water, which the air-pumps were not powerful enough to reduce or get rid of. To accomplish this, I propose that the channels, &c. shall be as described above.

An objection may be started, that, upon this plan, the wheel would have to propel a double body, the after-part of the paddle-box operating as the second. To this I reply, that until the accumulating water stopped the wheel in the London Engineer, she made as much way as her most sanguine friends could have anticipated.

Unwilling to trespass further on your valuable pages,

I remain, Sir,

Yours, very truly,

PHILO-TECHNUS.

Description of the Drawings.

Fig. 1 is a view of the vessel afloat.

Fig. 2 is a plan of the vessel.

F, the fore-cabin.

G, crew's birth.

HHHH, paddle-box and wheel.

I, the steward's-room.

PP, the water-channel.

L, the engine-room.

VV, the valves.

M, the after-cabin, &c.

Fig. 3, section of the paddle-box, wheel, and channel.

TO MAKE PAPER CARPETS AS A SUBSTITUTE FOR OIL-PAINTED FLOORCLOTHS.

Take linen or cotton, cut it to the size of the floor you intend to cover, sew it together; if cotton, wet it, and having pasted the floor all round (about a hands-breadth from the skirt-board), strain it and fix it by the paste. When the cloth thus fixed is dry, lay on it one or more coats of strong paper, and finish by covering with hanging-paper, of whatever quality or figure you please, and border the same according to fancy. Centre, corner-pieces, &c. may be laid, corresponding with the border, according to the taste of the manufacturer or that of his customer. There is no absolute necessity of laying other than the paper which forms the pattern of the carpet on the cloth; for the coat or coats of strong paper, above-mentioned, between the muslin and the pattern of the carpet, is solely for the purpose of strengthening the carpet, and contributing to its durability. When the carpet is thus far prepared, and the paste which has been used in attaching the paper and muslin together is quite dry, give it two coats of glue, or such size as is made from the shreds of skins, and used by the carvers and gilders, which glue or size must always be put on as warm as possible; great care must be taken that no part of the paper is left unsized, otherwise the varnish (hereafter described) will sink

into the paper and spoil it. When the size thus laid on is perfectly dry, give the carpet one or more coats of boiled oil; and when dry, one or more coats of copal, or any other varnish, according to the degree of polish or lustre that may be required. The copal and other varnishes are liable to crack, in which case water or any other fluid may penetrate to the oil, but will be prevented from doing further injury to the carpet by the oil, which cannot crack, and will prevent either water, or any change in the atmospheric air, from affecting the size which separates the varnish from the paper. There is no absolute occasion for any other varnish than boiled oil. The carpet, however, will require more time to dry, when covered with several coats of boiled oil, than when partly coated with boiled oil, and partly with varnish. To floors that are tight, smooth, and even, fancy paper, linen, or cotton, may be pasted on the bare boards, and will wear extremely well. They are, however, liable to two objections—the joints of the boards will be seen through them; and should the boards shrink, the paper carpet will break at the joints.

The above carpets are portable, and may be made at the manufactory to fit any room, by taking the dimensions thereof. Those carpets that have many thicknesses of strong paper will require hammering to smooth the joints of the paper. The carpet may be made without the assistance of any kind of linen or cotton, by pasting paper to painted boards; when, by repeated coats of paper, it is become strong and firm, it will forsake, or may be separated from the paint, and will be as durable as if mounted on linen or cotton.

The above-described carpets may have two faces, or different surfaces, by pasting paper to both sides of the linen, cotton, or paper, and pursuing the process above described. Carpets made of linen, cotton, or paper, or composed of all three, that are intended for halls, passages, or other places much exposed to wet, should be oiled on the under side, and well varnished upon the upper one; the edges should also be bound with leather, or some other strong substance, and well oiled, to prevent water, rain, mud, &c. from penetrating the paste. The paste used in the preparation of the paper carpets ought to be very strong (perhaps the best or strongest is to be procured by substituting beer or sweet-wort for common water). The paste must be kept free from lumps; and when taken from the fire, stirred until it is cold. Papers used for carpets must have, in the printing or stamping them, sufficient gum or size to enable them to stand the effects of the warm size mentioned above. The papers may be printed in oil for these carpets, by giving the paper a strong coat of size upon the back, which will prevent the oil from penetrating the paper, otherwise it cannot be pasted to linen, cotton, or any thing else: one edge must be left untouched by the oil for the lap, and white lead must be substituted for whiteuing in the compound of colours. Paper thus prepared and printed or stamped will not require any size between the colours and the boiled oil, as before-mentioned.

When these paper carpets become soiled, they may be cleaned in the following manner:—1st, They must be swept clean, then wiped all over with a damp spunge or cloth; they may then be wiped over with sweet skimmed milk, which will refresh them very much. When they require to be re-varnished, clean them as above, then wipe them with lime-water to take off the grease, and varnish them as often as you please. When they are totally defaced, wash all over with a ley of potash, which will destroy the former varnish. They may then be sized and varnished in the same manner as before described, and the colours will be as fresh as when first laid down. Whenever they are removed, they ought (if varnished only on one side), to be rolled with that side out, to keep the varnish on the stretch, to prevent its cracking. The brush for sizing the above carpets may be like a white-washer's, only thicker, and as long in the handle. The brush to varnish with should be the size of about three-pound brushes, fixed to a long handle. It is found by experience that japan varnish is the best for the above carpet.—*London Journal of Arts and Sciences.*

LORD BYRON'S OPINION OF MECHANICS' INSTITUTIONS.

The following remarks of Lord Byron, which we extract from a highly interesting work which has just made its appearance, entitled, "The Last Days of Lord Byron," by Major Parry, are strikingly corroborative of certain opinions which we have ourselves repeatedly expressed on the subject. His Lordship, indeed, would have gone farther than we were disposed; he would have confined the management of the Mechanics' Institution to mechanics *entirely*, while we were willing that one-third of the managers should be selected from other classes. It must be confessed, however, that all the experience which we have yet had of this joint sort of

management, is in favour of Lord Byron's opinion.

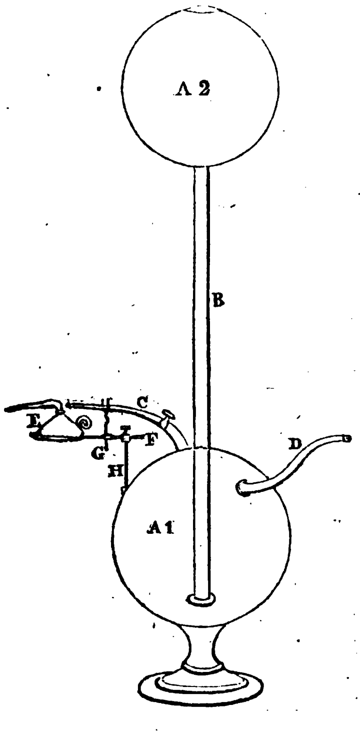
"After my acquaintance with Lord Byron, he took a great interest in all that concerned the welfare of the working classes, and particularly of the artisan. 'I have lately read,' he said, on one occasion, 'of an Institution recently established in London for the instruction of mechanics. I highly approve of this, and intend to subscribe 50*l.* to it; but I shall accompany the order for the money with a letter, giving my opinion on the subject. I am always apprehensive schemes of this description are intended to dupe people, and *unless all the offices in such an institution are filled with real practical mechanics, the working classes will soon find themselves deceived.* If they permit any but mechanics to have the direction of their affairs, they will only become the tools of others. The real working man will soon be ousted, and his more cunning pretended friends will take possession, and reap all the benefits. It gives me pleasure to think what a mass of natural intellect this will call into action; if the plan succeed, and I firmly hope it may, the ancient aristocracy of England will be secure for ages to come. The most useful and numerous body of people in the nation will then judge for themselves, and, when properly informed, will judge correctly.'"

THE PRIZE CHRONOMETER.

The Prize of 300*l.*, assigned by the Lords of the Admiralty, for the best Chronometer, after one year's trial at the Royal Observatory, Greenwich, has just been awarded to Mr. R. Widenham, of East-street, Red Lion-square, a very young and ingenious artist. His chronometer, which was an elegant piece of mechanism, only suffered an extreme variation of one second and eighty-four hundreds of time within the year, according to the table of mean rates, computed by the Astronomer Royal from actual daily observation. When we consider the state of mechanics in the time of Dr. Hook, early in the last century, when the attention of the Royal Society was first drawn to the *theory of springs*, and even the state of arts at the much later period, when Mr. Harrison was awarded by Government 10,000*l.* for his chronometer, we cannot help being struck with the very great improvement which has since been made in the construction of an instrument of such commercial and maritime importance, and gratified to know how much of it is due to the skill and perseverance of unpretending names among our own mechanics. There are, in general, thirty chronometers sent to the Royal Observatory for competition: Mr. Widenham's having varied the least, has been purchased at the prize value by the Lords of the Admiralty.

IMPROVED SIMPLE BLOWPIPE.

SIR,—I beg leave to submit an improvement on the Simple Blowpipe, mentioned in the 84th Number of your valuable Magazine.



Description.

A 1, A 2, are two boxes, or globes, made of tin or copper.

B, a pipe, of any size or length, reaching from the bottom of A 2 to near the bottom of A 1.

C, the blast-pipe, with a stop-cock.

D, a mouth-piece or nose of bellows, with a valve on the inner end, to prevent the escape of the air.

E, the lamp.

F, the slide.

G, the crutch, for the pipe to rest upon.

H, the stand, fixed to A 1, to support the lamp, &c.

I think an apparatus made on the above plan would be very powerful either for the bench, the forge, or the furnace; its power may be increased to any extent by lengthening the pipe, B.

A 2 should be open at the top, and A 1 filled with water.

*****.

Hertford-street, May Fair,
April 9th, 1825.

METHOD OF PREVENTING THE WATERING OF SILKS WITHOUT THE USE OF THE KNEE-ROLL.

There are two imperfections which silks, especially plain ones, are liable to acquire in the loom. One, called cockling, is merely an unevenness of the surface, and arises usually from one longitudinal edge or selvage of the piece being more stretched than the other, in consequence of its not being wrapped evenly round the roll or cylinder of the loom. The other imperfection, called watering, is a wavy or streaky appearance, produced by a play of light on the surface of the silk, though that surface may be quite smooth. The cause of this wavy appearance is not completely understood, but appears in a great measure to depend on unequal pressure being given to the piece while on the roll. It is well known that the highest polish and gloss are given to silk in the hank by twisting it hard, and at the same time giving it a kind of oscillating movement, so that each individual thread may be rubbed repeatedly on those with which it is in contact, whereby they mutually polish each other. Now, a piece of silk, in the process of manufacture, may be conceived to be placed in circumstances considerably favourable to the production of this partial polish, if, when rolled tight and rather unevenly on the roll, it is subject to the vibration occasioned by the stroke of the lay upon the weft, which takes place after every throw of the shuttle.

The contrivance which used to be resorted to in order to prevent the watering of silks, was by means of a knee-roll. The five or six yards, which constitute an average day's work, being first rolled on the large or breast-roller during the weaving, were every evening transferred to a smaller roll, called, from its position, a knee-roll. In doing this great care was required to lay each fold precisely upon the preceding one, a manipulation that occupied about half an hour; and the silk, by frequent handling, was apt to become soft and less saleable.

Of late years, attempts, more or less successful, have been made to avoid the use of the knee-roll, by inserting a sheet of thin glazed pasteboard at certain intervals between the folds of silk on the breast-roll, which, from its elasticity, yields to the vibration of the loom without communicating any motion to the silk, while its own smooth surface allows it to move a little on the surface of the silk without any injurious friction. The most successful application of this contrivance has been made by Mr. Peter Caron, of Church-street, Bethnal-green, to whom the Society of Arts have voted a reward of five guineas. The following is the process :—

After a *porry* (a quantity of five or six yards) has been wove and rolled on the breast-roll, in the usual way, during the weaving, it is to be unrolled, and carefully rolled again as evenly as possible, a sheet of pasteboard or pressers' paper being put into the last turn. When a second porry has been finished, it is to be again rolled, as above-described, the sheet of pasteboard inserted in the last fold of the former porry being first removed; but at the end of every second porry, or twelve yards of work, the pasteboard which has been inserted is to remain till the piece is finished, especial care being taken that the pasteboard lies as

close on the roll as the work itself does. Mr. Caron has practised this method for several years, and during that time has not had a piece in the slightest degree watered. The kinds of work to which it has been applied have been gros de Naples, Florentines, and double-twilled sarsnets.

Plain sarsnets are very liable to cockle, or run into ridges, when the warp is uneven. This may be prevented by inserting a glazed pasteboard in every twenty-four yards of work, and leaving it there till the piece is finished.

STANDARD MEASURES.

SIR,—If C. H., in your 75th Number, cannot completely understand the scientific communication of T. H. Pasley, in Number 73 of your entertaining miscellany, I will, with your permission, endeavour to convince him, in a manner less learned than that interesting Correspondent, trusting it will be more explanatory, studying simplicity and clearness for plainer instruction.

C. H. appears to labour under a mistake altogether concerning the *natural* standard: it is not an *artificial* lineal standard measure that is required; that is already determined, and is the distance, on a metal rod, from the centre of two gold pins fixed in it for that purpose, and is kept as a pattern or standard in his Majesty's Court of Exchequer, to regulate all measures of length and capacity by. The natural standard is that by which this artificial one could be recovered, if lost or destroyed; or, in other words, if one is put into a person's possession, how would he describe its exact length by writing to his friend at a distance? That this is a problem of great difficulty, no one can doubt; and though numerous attempts have been made, no one has hitherto accomplished its solution.

The propositions lately offered are entirely inapplicable to the purpose, as they all revert to the artificial standard in the end. The diameter of the sun, at any given time of the year, must depend finally on the artificial measure of the length of the radius forming the arc by which the sun's diameter is measured. The diameter of the moon, again, is liable to even greater objections; and the distance between Betelguese and Bellatrix (the two stars forming the shoulders of Orion) terminate finally in the very same way.

The length of the barleycorn is the supposed natural standard of English measure; but this is an uncertainty, as barley grown on different soils differs considerably in length, particularly highland and lowland, or that grown on light fenny or heavy clay soils. The cubit, or distance from the elbow to the finger-end, and the foot, originally the human foot, without doubt, are also liable to the very same objections. So also the proportion of C. H., as to "the best height of a man," ends in the very same reference at the conclusion, viz. What is the height of the best-sized man? His answer is so many feet, and the length of this foot is the question sought.

In examining the library of an antiquary, I find the measures of capacity are described as containing so many hens' eggs (whole, I suppose): this gives a good idea in general of their true size; but for scientific purposes the egg of any domestic fowl is the worst possible for selection, as all domesticated animals differ most in their size, by the attention paid to their keeping or diet, climate, &c. branching out into endless varieties. Had the length of the hedge-sparrow's egg been taken as a standard measure, or that of the crow, they would, I conceive, have been much nearer the truth, especially if the latitude and longitude be noted; for even wild birds differ in size in different latitudes or climates, though not so much as the tame: the fowls of Bantam and England will differ in size greatly, and consequently their eggs in the like proportion. Seeds, whether in capacity or length, are also under the same difficulty, of being both small and great. It has been proposed to take the number of turnip seeds, or acorns, which a vessel will contain,

or the length of them respectively, but all will by cultivation differ. In short, neither the animal nor vegetable kingdoms can be safely resorted to for any universal standard.

Weight and capacity also depend upon the lineal standard; for if a given weight of metal is resorted to, to find that weight requires that the same standard should be sought; whether it is a globe, or a cube of ice, of a given weight, the length of the diameter of one, and the side of the other, must be found to determine those weights.

The size of a man is one of the most deceptive and fallacious C. H. could think of: the great diminution of the human body in England, since the use of ardent spirits, is perhaps what he is little aware of. Colquhoun says, it is difficult now to find in London the adequate number of men of the height required for the militia; and if C. H. would observe the armour for our ancestors in the time of our Henrys and Edwards, now in the Tower, he will find "*their best height*" differs from ours, as much as the English fowl and the Bantam.

The two nearest and best approximations yet made to this desired object are, first, the measure of a degree of the meridian in a fixed latitude; secondly, the length of that pendulum which vibrates seconds at a certain elevation from the surface of the sea. These have already been determined with sufficient exactness for common and useful purposes, but the philosopher requires still greater exactness.

It may at first appear a singular fact to C. H., that a measure of length from that of time is the easiest as yet found, but such is the truth. Take, for example, the time from the noon of one day to the noon of the next, or about the longest day, when the sun has least difference in declination. Twenty-four hours being thus found, the divisions into hours and minutes is easily accomplished; and thence the length of the pendulum vibrating seconds, which, to be philosophically correct, must, as before said, be in a certain latitude, and at a certain distance above the level of the sea, on account of the irregular shape of the globe, and the inequality of the earth's surface.

Next, the length of a degree from a given latitude, because the degrees of latitude differ all the way from the Equator to the Poles. The globe not being a perfect sphere, the measured portion of the meridian must be taken in our own country for a standard. The great length of this measure on the surface of the earth renders it liable to error, but the perfection of instruments to measure angles has brought this plan much nearer to perfection than formerly.

Now, if C. H. will describe our visible artificial standard, in such a way as a friend may make himself one from his description, or that posterity may know the height and magnitude of our edifices by biblical records, when our cities are destroyed and our buildings demolished, history giving their dimensions in feet, he will effect the desired object; and length and measure, capacity and weight, will be regulated for ever.

Wishing him success in his researches, and craving your pardon for the length of this letter,

I remain, Sir,

Your constant reader,

S. THURLEIGH.

TAX ON BEER.

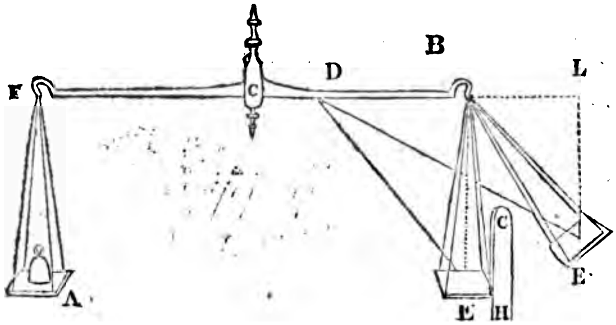
SIR,—Fearing that some of your Correspondents might fall into the same misapprehension of my views, on the subject of the high price of beer, that you appear to have fallen into in your last Number, allow me a few words in explanation.

I am not the advocate of a tax on beer, or of malt *used for the purpose of making beer*. I should have used the word *inequality*, and not *injustice*, as put in italics in your 88th Number. What I mean to contend for is, that as the relative taxes of malt and beer now stand, there is no injustice or inequality, because, in my view of the case, the brewer of his own beer pays as much tax out of his shilling as the man who drinks the public-house beer. If I were to

suggest any remedy, it would be to take the tax off beer, but to take it also off all malt used for brewing beer, and let the whole weight of duty fall on the malt used for spirits.

Your obliged Correspondent,
A Real Blacksmith.

PROPERTY OF THE BALANCE.



Sir,—In Emerson's Mechanics we find the following demonstration of Holsham's property of the Balance, which has been so much the subject of discussion in your pages:—

"Let EL be perpendicular to FB; then the force, at E, to turn the scales, is to the contrary force at F as CL to CF or CB; for it is the same thing as if E was suspended at L. And when the perpendicular obstacle, GH, hinders the scale from going out, let ED be the force acting against D; this is equivalent to the two forces, EB, BD, acting at E and D. The force, BD, tending to or from the centre, does nothing, but the force, EB at E, acting at the distance, CB, its power to bring down the scale, E, is CB × BE; and the same force acting at D, its power to push up the scale is CD × BE, and their difference, DB × BE, is the absolute force to thrust down the scale, and if D were on the other side of C, the force would still be DB × BE."

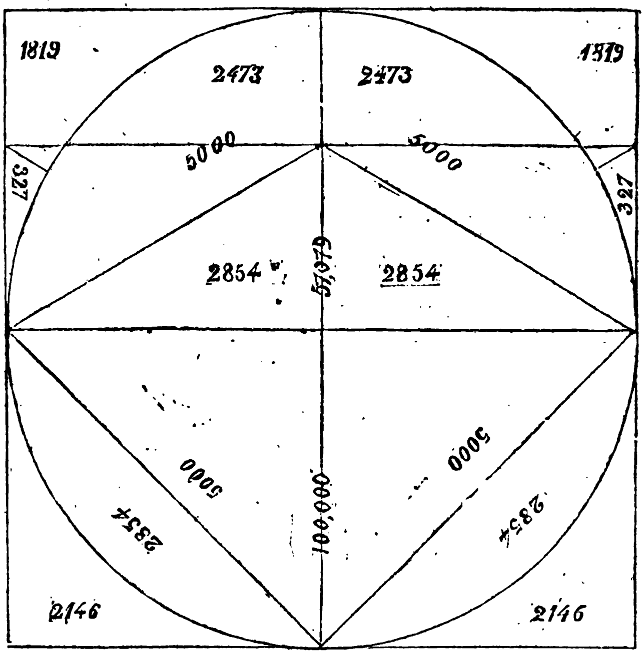
In addition to this we may add, that the man's preponderance (when the scale is prevented from leaving the perpendicular) is equal to the force with which he pushes against the beam, multiplied by the sine of the angle EDB, multiplied by BD; for, let DE represent the oblique force exerted by the man against the point D, then, by the resolution of forces, this may be resolved into the two, DE, EB. But as DB is in the direction of the beam, it can have no effect in turning it about its centre, C; therefore BE is the direct force, and DE : BE :: radius (1) : sine ∠ BDE, that is (multiplying means and extremes, and denoting the oblique force DE by F), F × sine ∠ BDE = BE, which, multiplied by DB, equals the man's preponderance, for action and reaction are equal and contrary; therefore the direct force, BE, cuts at D in a contrary direction to what it does at B; consequently its moment, BE × CD, must be subducted from the moment BE × CB = BE × CD + BE × BD of the force acting in the contrary direction, their difference, BE × BD = F × sine ∠ BDE × BD = the man's preponderance. Q.E.D.

Example.—Suppose a man standing in one scale of a balance, and counterpoised by weights in the other; press against the point, D, of the beam, two feet from the point of suspension, with a force of fifty pounds, the stick with which he pushes making an angle with the beam of 30°; what weight must be added to the scale opposite to that in which he stands to restore the equilibrium?

Now, F = 50 ∠ BDE = 30°, and BD = 2; therefore F × sine ∠ BDE × BD = 60 × .5 (sine of 30°) × 2 = 50lb., the answer.

I am, Sir,
Your obedient servant,
William Lake.
Bulbourne, near Tring.

CONSTRUCTING A CIRCLE AND PARALLELOGRAM ON GEOMETRICAL PRINCIPLES.



Sir,—Having constructed a diagram, consisting of a circle, and a parallelogram, which I had reason to believe, from trigonometrical calculations, were very nearly equal in area, I discovered a curious coincidence while contemplating the two figures, which induced me to think that I could construct, on simple geometrical principles, applicable to any magnitude, a circle and parallelogram which would possess the same equality as the figures in the diagram, obtained from previous calculation. I accordingly constructed the new diagram, and, on comparing it with the other, I could not perceive any difference between them. I then wished to give it publicity, under the expectation or hope that some of your intelligent readers would bestow a thought upon it, and favour us with an opinion; for I have not time, nor access to the proper sources of information, to enable me to attend to such matters. Permit me, therefore, to request the favour of its insertion in your valuable miscellany.

With any radius describe a circle, and on it construct the circumscribing square; draw a perpendicular diameter, and from the point of intersection in the periphery, with the original radius unaltered, cut off an arch at each side, the sum of which two arches will be 120° from the centre; draw the two radii, which will intersect the extremities of the great arch, and produce them until they cut the perpendicular sides of the square; join the intersecting points in the two sides of the square by a right line, and you will divide the square into two parts, the greater of which shall be equal in area to the circle.

We now proceed to the following calculation:—The right line drawn across the square cuts from the

circle an arch containing $110^\circ 23' 20''$, the half of which is $55^\circ 11' 40''$; the cosine of the latter arch or angle is 57.079.63; therefore the altitude of the parallelogram must be the latter quantity plus the radius, and its base must be equal to the diameter; its rectangle will be $200{,}000 \times 157.07965 = 31415.930000$.

Let us now endeavour to analyse our diagram, and, in the first place, let us endeavour to calculate the area of the segment cut from the circle; its arch contains $110^\circ 23' 20''$, equal to $397{,}400''$; the circle is equal to $360^\circ \times 60' \times 60'' = 1{,}296{,}000''$, and we have thence the following analogy or proportion—1,296,000 .. 397,400 : : 3141593, &c... 9633, &c.; therefore the sector which includes the above-mentioned arch contains 9633, but the sector contains the segment and a triangle, the altitude of which is the cosine before mentioned, and its base is double the sine of the same arch or angle; $\therefore$ cosine 57,079, &c. $\times$ sine 82,115, &c. = 4687, &c.; sector = 9633 − triangle = 4687 = segment 4946.

We may here stop to observe, that having cut off the segment, the remainder of the circle is contained by the parallelogram; but there are four portions of the latter outside the circle, viz. 2146, 2146, 327, 327, the sum of which is 4946 = to the segment.

It has been long since demonstrated that any sector of a circle is equal to a rectilineal triangle which has radius for its altitude, and the periphery of the sector for its base; and it is a very curious coincidence, that without any preconceived calculation on that principle, we should find the portion of our diameter, forming the base common to the two triangles, exactly what we would estimate as the rectilineal magnitude of the periphery of a quadrant; thereby forming the base of a triangle which has the periphery of a sector for its base, and radius for its altitude; and that sector being a quadrant, the two triangles are each equal to a quadrant of the circle in which they are inscribed, and their sum equal to the semicircle.

We may now observe that the inscribed square in a circle will always be an integral quantity when the diameter of the circle is integral, because it is formed by the chords of the quadrants, or each side is the chord of 90°, and is therefore the hypothenuse of a right-angled triangle, the two legs of which are two of the radii of the circle.

Let radius equal 10,

$$\left.\begin{array}{l}\text{then } 10^2 = 100\\ \text{and } 10^2 = 100\end{array}\right\}200, \text{sum of squares;}$$

therefore the inscribed square contains 200.

Let radius equal 100,000, &c.

57,07963, equal cosine, as before.

157,07963, equal base of triangle.

Let radius equal 10, &c., diameter = 20, &c., and periphery = $31415926 \times 20 = 62831852$; which $\div$ 4 gives periphery of quadrant 15,707963.

I remain, Sir,

Your most obedient servant,

RICHARD DOWDEN.

Cork.

CHEAP GLASS HYDROMETER.

SIR,—In the hope that it will prove useful to many of your readers, I herewith send you directions for making a Glass Hydrometer, of the kind invented, I believe, by the late Mr. Nicholson, which possesses considerable advantages in point of efficiency, extreme susceptibility, and economy. Mr. Nicholson's hydrometer, sold at the shops, is usually made of brass, and has a scale instead of the bottom bulb, for the purpose of ascertaining the specific gravity of solid substances, the want of which, in the one I recommend, may be supplied by suspending the substance to the lower stem by a hair. The principal advantage of the latter instrument over the former is its cheapness, the one being sold for five guineas, and the other costing not more than as many shillings. The glass one is equally accurate and susceptible with the former, less liable to be acted on by the fluids in which it may be im-

mersed, and more easily cleaned. It may be admitted, on the other hand, that its fragility is a disadvantage, but, with tolerable care, it will last for years, and, in case of being broken, the weights, scale, and stem, may all (except, perhaps, the balance-weight) be used in making another.

I am, Sir,
Yours respectfully,
J. S. M.

The Hydrometer is made of glass, excepting the scale, which is of brass, and the stem, which is of hardened steel-wire, about 1-35th of an inch in diameter; load the lower bulb of the instrument with *small* shot, nearly sufficient to sink the instrument to its neck in water; then fix the stem into the neck temporarily, by running it through a cork made to fit; put the instrument again into water, and load the scale until it sinks to the middle of the stem. The weight in the scale added to the weight of the instrument will equal the weight of water displaced by the instrument; then, as the specific gravity of water, or 1000, is to the specific gravity of the lightest fluid, of which you wish the instrument to ascertain the specific gravity, so is the weight of water displaced by the instrument to the weight of which the instrument ought to be made.

Having found this weight, unfix the scale and stem, and make the instrument, including the stem and scale, with the shots, about equal to this weight; then insert a piece of cork in the tube between the two bulbs, to keep the shots in the lower bulb, and fix the stem permanently and *securely* into the neck of the instrument; in order to which, make the cork fit very tight, and let it be rather longer than the neck: the part of the stem which is to be inserted in the cork should be warmed and rubbed with sealing-wax before it is inserted, and a little sealing-wax should be applied around the bottom of the cork where the stem comes through it, by which means the stem will be securely fixed in the cork after the latter is compressed by the neck of the instrument; when this is done, and the cork made to fit as tightly as may be to avoid the danger of breaking the neck, cut the cork level with the top of the neck, and cover it carefully and evenly with sealing-wax (which I find to be the best cement for the purpose), taking care there are no air-bubbles left in it.

The instrument is now made, ascertain its weight *accurately*, and call it a; immerse it in distilled (or filtered rain water), of a given temperature (60 deg.), loading it with weights until it sinks to the middle of the stem; call the sum of these weights b: then the instrument being immersed to the middle of the stem in any fluid of 60 degrees,

If it carries the weight of	The S. G. of the fluid will be
$b - \frac{\overline{2a+2b}}{1000}$	998
$b - \frac{\overline{a+b}}{1000}$	999
b	1000
$b + \frac{a+b}{1000}$	1001
$b + \frac{2a+2b}{1000}$	1002.

So that, by finding $\frac{a+b}{1000}$, and adding it to, or subtracting it from, the weight last found, a table may easily be made, by referring to which the specific gravity of the fluid under trial may be ascertained immediately to the fourth place of figures; and by subjoining a table of differences it may be ascertained with very little calculation to the fifth and even the sixth place of figures; and, generally, as $a + b : 1000 :: a +$ its load when sunk to the stem, the specific gravity of the fluid, the temperature being the same, say 60 degrees.

It will be found convenient to make one weight equal to b, or nearly so, and to use this, which may be called the water-load, with all fluids heavier than water, and calculate the table accordingly.

As this kind of hydrometer is not generally sold, nor the glass part to be had at the shops, I may observe that the latter will be best obtained from the Italian thermometer-makers. I have had mine blown for me by Mr. Pastorelli, of Cross-street, Hatton-garden, who charged me, if I recollect right, 1*s.* 6*d.* or 2*s.* for each; for the scale and stem fixed to it I have paid 1*s.*, so that the instrument, exclusive of the weights, will not cost more than 3*s.* The necessary weights are a set of grain and of pennyweights, and for cases in which great accuracy is wanted, a set for weighing decimals of grains, which last are best made of fine silver or plated wire.

This hydrometer combines the advantages of economy, accuracy, and of detecting a very minute variation in the specific gravity of fluids more than any other which I have met with. The last quality depends on the proportion between the bulk of the instrument and of the diameter of the steel stem; the one which I generally use is about seven and a half inches long, and weighs, with its water-load, 3071.2 grains. When immersed to the middle of the stem, the addition of .2 of a grain will produce a

sensible alteration, from which it is evident that the instrument will detect a variation of 1-20,000th part of the weight of the fluid.

This instrument requires much less liquor to use it than those with a long stem: the one above-mentioned requires nearly a wine quart, but it is larger than necessary. I have others so small as to be capable of being used with about half a pint, which will show the specific gravity to the 1-5000th or 1-6000th part.

The larger instrument will act with all fluids, from 800 to about 1250. If this range be insufficient, it may be increased by increasing the length of the tube which connects the two bulbs, and *vice versa*.

I will not detain your readers longer than just to observe that this instrument affords a very accurate balance, indicating to .1 of a grain the weight of any thing weighing less than two or three ounces troy.

I must add, that the efficiency of the instrument evidently depends on the cork being impervious to water, which I have found to be completely effected by the means I have described, as I have repeatedly ascertained, by keeping different instruments immersed for 24 hours and upwards.

NECESSITY OF PROTECTING HUMBLE GENIUS.

The necessity of such an Institution as that which we announced the week before last, for "the Assistance, Encouragement, and Protection of Native Genius," is strikingly exemplified in an able article on the subject which appears in this month's Number of the "London Journal of Arts and Sciences." It details a most heartrending case of hardship and suffering, arising from the want of that aid which this Company is intended to supply. The unfortunate sufferer was James Cross, the inventor of a substitute for draw-boys, which we have before noticed in our pages:—

"At various times he had effected many important improvements in the weaving machinery used for figured fabrics, which, by his unwearied application, he at length brought to such perfection, as, with other great advantages, to render unnecessary the use of draw-boys. During the progress of his labours, he was frequently encouraged by the manufacturers of Paisley, who saw and fully appreciated the value of his genius, with hopes of ample remuneration for his persevering application. But when the inventions were pronounced complete, and *more than* his little means had been expended in arriving at this pefection, his only recompence was the high *verbal* approbation of his munificent and benevolent patrons; and that, too, *after they had been entirely satisfied by actual experience of the great worth of the invention, and were daily reaping benefit from them.* The Board of Trustees for the improvement of manufactures in Scotland awarded poor Cross a hundred guineas, which alone is a convincing argument in his favour; but this liberal gift was sunk in the perfection of his invention, and even then the poor victim was involved in debt. Unable to sustain such a pressure of accumulated misery, his health, previously injured by the privation he underwent to gather the means to prosecute his work, gave way to anguish and blighted hopes; and after more than twelve months lingering in expectation of at least a partial fulfilment of the brilliant prospects which had been held out to him, he died the broken-hearted sacrifice to avarice and base ingratitude, leaving a young, helpless, and motherless family, to inherit his PENURY and FAME.

—— 'What man seeing this,
And having human feeling, does not blush
And hang his head, to think himself a man?'

"Mr. Cross's numerous inventions form a grand era in the history of the art of weaving, and will be admired by posterity when the name and the woes of the humble author will have sunk together to oblivion; but we can here only give a brief outline of them. So early as 1804, he first commenced his observations upon the defects of the machinery then used for weaving, and almost every succeeding year his fertile genius produced some valuable improvement. In 1817-18, he made the first working model of his machine for weaving harness-work without the aid of draw-boys, and submitted it to the inspection of a number of manufacturers and operative weavers, who unanimously spoke of it with the highest encomiums.

"This model being on rather a contracted scale, and necessarily imperfect, he was strongly recommended to construct one of larger and more serviceable dimensions, and was given to understand that his adviser would cheerfully pay every expense, whether or not his attempts were successful.

"Thus encouraged, he proceeded in his labours; but from many untoward circumstances, they this time proved unsatisfactory, after incurring an expense of 18*l.* 15*s.* 6*d.* To defray this, as he had been promised, a subscription collected

amongst the manufacturers produced 12*l.* 15*s.* 6*d.*—leaving him a loser of 6*l.*, besides much valuable time. Notwithstanding these losses and frequent interruptions, from his very weak state of health, by persevering industry, during every moment's respite from disease, in 1820, he erected a larger machine. This he submitted to a Committee of manufacturers and weavers, who very highly approved the principle, and warmly recommended a meeting, to "consider the propriety" of remunerating him.

"A subscription, for the purpose of enabling him to prosecute his labours yet farther, was the consequence of this meeting, and the liberal amount of the collection was 16*l.* 7*s.* 6*d.*—from which poor Cross had to pay for wages, &c. upwards of 12*l.* With the residue he was to "*prosecute his labours*," and maintain his family (then six in number, entirely dependent on him) for five months. Subsequently, being blessed with a short return of comparatively good health, and yet undismayed by the pitiful encouragement he received, he finished another machine of more extended and perfect operation. This also he laid before Committees of weavers and manufacturers. They were now so fully satisfied of his merits, that they this time gave *written testimonials* of their approbation (one signed by eighteen, and another by fifteen individuals); and a general meeting was called to *reconsider* the propriety of rewarding him, to which the public were invited by a circular letter widely distributed. At this meeting, a statement* of the poor sufferer's inventions was read, as also the flattering reports of the weavers and manufacturers, who had witnessed the operations of the completed machine; and the weavers were examined who then had it in actual practice. A subscription again succeeded this parade of mock generosity, and produced the magnificent sum of 3*l.* 1*s.* 6*d.* Such was the noble fulfilment of all the enticing prospects held out to him—all the generous promises, which induced him to sacrifice time and health, which might, and would otherwise have been employed advantageously for himself and family.

"In making the numerous experiments necessary to enable him to bring the invention to perfection, he expended and contracted debts exceeding 100*l.*, exclusively of the maintenance of his family during the long period that he was so engaged; and for this, the whole recompence he received from the manufacturers amounted, as we have shown, to 31*l.* 14*s.* 6*d.*! He now became but too fully sensible how miserably he had been deluded; and oppressed by all the horrors of debts, which he saw no possibility of repaying—harassed by continual anxiety, both of body and mind, and the bitter conviction of his utter destitution, his energies gave way beneath the accumulated mass of woe, his enfeebled body became the prey of sickness, and he sunk into a state of entire helplessness. Thus he lingered, the miserable victim of his own powerful genius, till March, 1824, when, at the early age of 45, he was happily released from further earthly trouble. Previously to his death, he had the satisfaction of seeing his machine generally adopted by the liberal manufacturers, and several gave written testimony of the great benefit they derived from it. The noble donation of the Board of Trustees came to cheer his latter days also, but it was too late to renovate his worn-out frame. But for the real benevolence of one individual, his four orphans (three girls and a boy, the last but six years old) must have become entirely destitute, and have suffered the very extreme of want. By his humane aid, however, and the employment of the eldest girl as a servant in one of the manufactories, as far as the calls of nature go, they are perhaps as well provided for as many of their neighbours in the same class; but not one of them has yet received *any education whatever*, and unless benevolence again exert itself, there seems no possibility of their ever obtaining it.

"Such has been the melancholy fate of one individual, and this one instance, it is hoped, will be thought a sufficiently convincing demonstration of the urgent and crying *necessity*, for the adoption of instant and energetic measures for obtaing a permanent barrier to its recurrence."

* "Extract from the Report of the Manufacturers, &c. being the statement alluded to:—

'Amongst the many improvements which Mr. Cross has made for the trade, may be mentioned—The Eyed Standard for Gauze Mountings; the Back Hiddles for Pressure Harnesses; the Barrel Machine and Harness; the extending Tail for double Harness, for contracting the Flowers, which, in many cases, saves nearly one-half the expense of flower-lashing, the pressing treddles not being required as formerly.

'These have all been proved to be of great use.'

ECONOMY OF FUEL IN HEATING STEAM-BOILERS, ETC.

Sir,—I wish to call the attention of your readers to the advantage to be derived, as regards the consumption of fuel, by making the flues which surround the boiler much nar-

rower than is usual. The common width is, I believe, nine inches, instead of which I would recommend them to be made not more than four, or four and a half inches wide. I think I am justified by my own experience, as well as by that of a friend of mine, who has also made the trial, in asserting that the saving in fuel, by the above alteration, will not be less than one-third of the whole. I have known it estimated at one-half, where it has been tried. I hope some of your readers will make trial of the plan, and communicate the result in your valuable work; and if, as I anticipate, it should be found to answer and become general, it certainly will be such an important saving as may fairly be reckoned a national advantage. I imagine that the principal reason for making boiler flues so wide as they are usually made, is, that a boy may be admitted into them, for the purpose of cleaning them, which purpose was, in the cases abovementioned, accomplished easily and effectually, by removing a stone or brick at each end of every fluid, and passing a brush with a long handle along them: this method will have the recommendation, to every friend of humanity, of superseding the necessity of climbing-boys in the instance alluded to. It will be seen that the plan is only adapted for those flues which are straight, or nearly so; but there are few which are not so. One disadvantage of the plan is, that the flues will require cleaning more frequently than when made on the present plan; but this is, I conceive, of no importance, compared to the advantage in the saving of fuel.

I remain, Sir,

Yours respectfully,

J. S. M.

MR. DICKENSON'S APPARATUS FOR CLEARING BEER.

Sir,—I observe, in Number 81 of your Mechanics' Magazine, page 390, an invention made by Mr. Dickenson, upon a plan, which certainly is a very good one, for clearing Beer, after being fermented in the gyle-tun; but if it is intended to supersede the use of the gyle-tun, I wish Mr. D. would communicate, through the medium of your valuable publication, his method of keeping down the temperature, which I think would be so high, from fermenting in a close vessel, as to injure and impoverish the beer.

Mr. D. would oblige if he would state the increase of temperature of each day during the fermenting process.

Yours respectfully,

Leeds, April 12th, 1825. XX.

WASHING MACHINE.

[MECHANICS' MAG., PAGE 424, VOL. III.]

(*Explanations requested.*)

Sir—Any hint to improve so important a business as *Domestic Washing*, is of too much value to be suffered to pass away for want of some little explanation—I allude to the short letter of your Correspondent, R. Burton, inserted in Number 83. I wish your Correspondent had been a little more explicit, and told us how the *board* is used particularly—whether it is placed in the bottom of the tub, or diagonally—whether the flutes are placed horizontally or perpendicularly—and whether the pressure is above or under water. It may be said, perhaps, that all this might be found out by experience; but I should like to try the way which your Correspondent says has been much approved of by very competent judges. Besides, my servants are very stupid, and would never *find out* any thing by *their* experience; indeed, we are thankful if they understand and do what is pointed out to them. Perhaps R. Burton may not think it too much trouble to write you a few lines more on the subject—it will oblige

Your constant Reader,

March 31st. Islington.

PROFIT AND DISCOUNT.

Sir,—"An Old Manufacturer" will find, on a review of his observations respecting Profit and Discount, that he has indeed "amused" himself, but by no means instructed his readers; and, to convince him of the fallacy of his reasoning, we will proceed to an investigation of the example proposed by M. W.

"Suppose an article cost 50*l*., on which it is wished to make 7½ per cent. profit, what must the selling price be, so as to be able to allow 3 per cent. discount?" No one will dispute, that if the selling price were 53*l*. 15*s*., 7½ per cent. would be the sum gained: but as a further discount of 3 per cent. is to be allowed, besides the clear profit of 7½ per cent., this

is only a first step towards accomplishing the object. Continue the operation by adding to............ 53 15 0

3 per cent. on 53	15	0	1	12	3
Ditto 1	12	3	0	0	11¼
Ditto 0	0	11¼	0	0	0¾

which together will make... £53 8 2¾

It appears this must be the gross selling price to allow 3 per cent. discount, and secure 7½ per cent. profit. As a proof, the following will satisfy, no doubt, the most sceptical:—

From gross selling price..	55	8	2¾
Deduct 3 per cent. discount	1	13	2¾
	£53	15	0
Deduct cost price.........	50	0	0
Leaving.................	3	15	0

or 7½ per cent. on money advanced.

The block against which "An Old Man" has stumbled, is in having calculated the percentage on the selling price of the goods, instead of on the capital employed. A slight view of the rules in any book on "Plain" Arithmetic, under the head of Profit and Loss, will set him right on this subject. That my supposition on this head is well founded, is evident from his assertion of gaining only 20 per cent. in selling goods for 100*l*. which cost 80*l*., and it must appear clearly to any one that the profit would be 25 per cent.

Again, he is equally unfortunate in his next proposition, "to gain 20 per cent. and allow 10 per cent. discount." He says, "let the prime cost be 72*l*."—the result of his labour is 100*l*. Now, the gross selling price, in this instance, need not be a penny more than 96*l*.

Gross selling price........	96	0	0
Deduct 10 per cent.......	9	12	0
	86	8	0
Deduct cost..............	72	0	0
	14	8	0

As 72 : 14 8 :: 100 : 20.

"An Old Manufacturer" speaks of his system as having been long used in the district where he resides; if it approaches no nearer to the truth than in the above examples, the sooner he adopts a new method the better.

I am, Sir, your obedient servant,

Old 'Change. X. M. N. R.

WATCH KEYS.

Sir,—The change in the shape of Watch Keys was not occasioned for mere fashion alone, as your Correspondent, Senex, in Number 67 of your amusing work, seems to think, but for the convenience of wearing. The old shape was so crooked as to be inconveniently liable to catch ladies' gowns in dancing, or when at any time assisting them; and by the entanglement, in very many mechanical operations, it caused the watch to be jerked entirely out of the fob, more particularly before braces or suspenders were used, which was about the same time that the form of the watch keys was changed. In riding, especially in leaning forward to open a gate, the key, from its many angular shapes (somewhat as crooked as the Isle of Man arms), often got fixed under the pommel of the saddle, and on rising, the watch was drawn out suddenly, or the chain broke.

The present form is doubtless the most covenient for *wearing*, though certainly not for *winding*; but as the wearing is for twelve hours or more, and the winding for less than half a minute, custom has naturally, in my opinion, given rise to the present shape, notwithstanding the truth of Senex's observation as to the winding up.

A triple-jointed steel key was invented to remedy the inconveniences of both the above-mentioned, which, when suspended and at liberty, was in a vertical posture, but on application it was of the old shape. Gold or copper, however, is not strong enough for joints so small, and a steel key does not harmonize well with gold seals and chains, or even gilt ones; though this kind is now much in use with the lower classes in the country, particularly ploughmen and carters, mostly accompanying a steel chain. The least satisfaction to any of your Correspondents will be a pleasure to

Agricola.

NEW PATENTS.

Chevalier Joseph de Mettemberg, Foley-place, Mary-la-bonne, physician; for a vegetable mercurial and spirituous preparation called *Quintessence Auleptiroque*, and also a particular method of employing the same by absorption as a specific and cosmetic.—Feb. 26.

J. Masterman, Old Broad-street; for an improved method of corking bottles.—March 5.

A. H. Chambers, and E. Chambers, Stratford-place, Mary-la-bonne; and C. Jearrard, Adam-street, Manchester-square; for a new filtering apparatus.—March 5.

W. Halley, Holland-street, Black-friars-road, iron-founder and blowing-machine maker; for improvements in forges, and on bellows or apparatus to be used therewith or separate.—March 5.

R. Winch, Steward's-buildings, Battersea-fields, engineer; for improvements in rotatory pumps for raising water, &c.—March 5.

W. H. James, Cobourg-place, Winson-green, near Birmingham, engineer; for improvements on railways, and carriages to be employed thereon.—March 5.

W. Hirst and J. Wood, Leeds; for improvements in cleaning, milling, or fulling cloth.—March 5.

J. L. Bond, Newman-street, Mary-la-bonne, architect, and J. Turner, Well-street, Mary-la-bonne, builder; for improvements in the construction of windows, casements, folding sashes, and doors, by means of which the same are hung and hinged in a manner adapted more effectually to exclude rain and wind, and to afford a free circulation of air.—March 9.

T. Hancock, Goswell-mews, St. Luke's, patent cork-manufacturer; for a new manufacture which may be used as a substitute for leather and otherwise.—March 15.

T. Hancock, Goswell mews; for improvements in making ships' bottoms, vessels and utensils of different descriptions and various manufactures, and porous or fibrous substances, impervious to air and water, and for coating and protecting the furnaces of different metallic and other bodies.—March 15.

ANSWERS TO INQUIRIES.

NO. 73.—SHARPING KNIVES.

Strap your penknife on a good razor strap, taking care to have the edge somewhat round, as a thin edge (although the blade be of the best steel) will not answer for cutting a pen. The advice, founded on practical experience, of

A CUTLER.

WHEEL CARRIAGES.

Mechanics' Magazine, Vol. III. p. 340.

SIR,—I would recommend to your Correspondent, "Fore-wheel," to look into page 444 of the first volume of your valuable work, and also the 99th, 138th, 145th, and 189th pages of the second volume. Let him pay attention to the observations which he will there meet with, and avoid the error recommended by many, namely, a horizontal draught; for, to be easy, the draught must be on an angle, and the best line is immediately from the axle. Although there is no objection to the splinter-bar or the shafts being raised according to the pleasure of the proprietor, yet they should be so high as to leave no chance of their being broken by the fall of the horse, should such an accident occur. If "Fore-wheel" will employ a person who will follow these rules, I am confident he will have a very safe and easy-drawn chariot.

I am, Sir,
Your constant reader,
G— G—.

CORRESPONDENCE.

M. W.'s reply to "the Old Manufacturer" did not come to hand till the volunteer reply, inserted in the present Number, was in print. He may now probably wish to make some alterations in his paper; if so, we shall be glad to receive them before Tuesday.

The information so much desired by several Correspondents from "Abel Handy," will appear in our next.

Communications received from—G. Wilson—Tudor—A. B.—A Subscriber at Deptford—X. Y. Z.—Another Blacksmith—Minor—W.R.Y.—Kappa--Gasometer---Peter Q.---A Stove-maker---H. A. C.—D. B.—W. B.—Emilius.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 90.] **SATURDAY, MAY 14, 1825.** **[Price 3*d*.**

"—— The Band of Commerce was design'd
T' associate all the branches of Mankind;
And if a boundless plenty be the Robe,
TRADE is the GOLDEN GIRDLE of the Globe.
Wise to promote whatever end he means,
God opens fruitful Nature's various scenes:
Each climate needs what other climes produce,
And offers something to the general use;
No land but listens to the common call,
And, in return, receives supply from all." *Cowper.*

VESSEL TO SAIL AGAINST THE WIND.

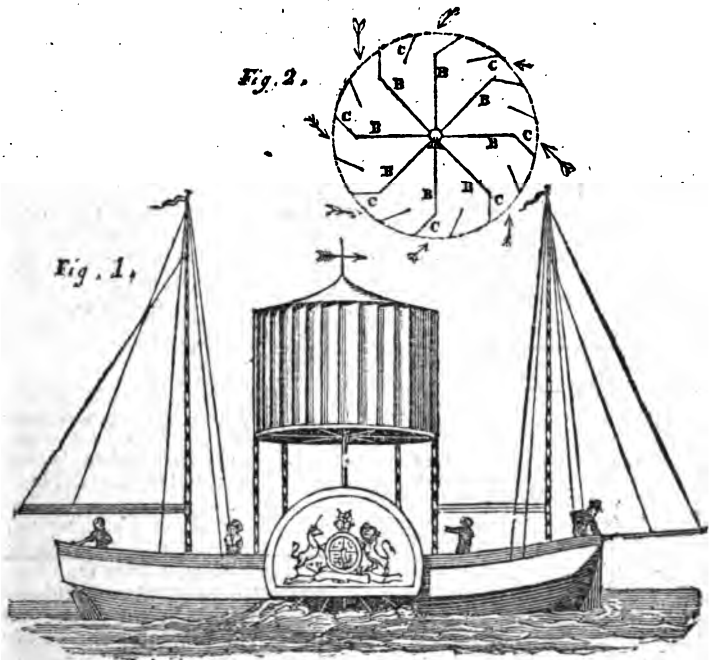
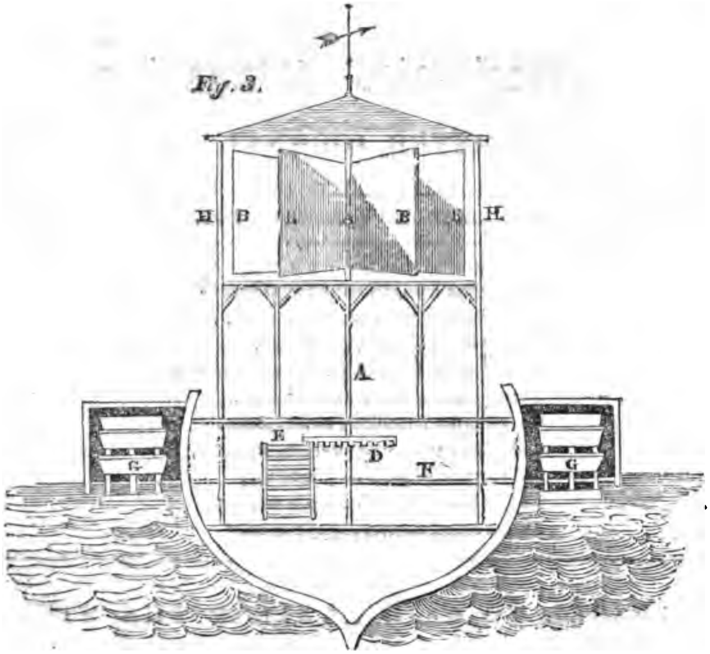


Fig. 2.

Fig. 1.

Fig. 3.



VESSEL TO SAIL AGAINST THE WIND.

SIR,—I send you the plan of a Vessel to sail against the Wind, or, as the sailors term it, "in the wind's eye."

I am, Sir,
Your obedient servant,
ROBINSON CRUSOE.

Description.

Fig. 1 is a view of the vessel complete.

Fig. 2 is a ground-plan of a wind-box. A is a vertical shaft, which supports the arms, BBBBBBB; to these arms are attached vanes or sails, which, when acted upon by the wind, cause the shaft, A, to revolve. CCCC are wind-guides, or thin boards placed vertically in the whole circumference of the wind-box, which allow the wind to pass between them in the direction marked by the arrows. By this arrangement, from whatever point of the compass the wind may blow, the vanes or sails must turn one way; and, by an inspection of figure 3, it will be seen that the vessel will proceed in any direction in which her head may be placed.

Fig. 3 is a transverse section of the vessel in midships. A, the shaft. BBB, &c. the vanes or sails. (The wind-guides are not shown in this figure, as they would obscure the vanes.) D, a cog-wheel, which, working in the trundle, E, turning the shaft, F, and giving motion to the paddle-wheels, GG, propels the vessel. HH, the wind-box.

CARMARTHEN GUNS SURPASSED.

SIR,—Your Correspondent, signing "W. R. D.", who gave his opinion on Carmarthen Guns, in your 88th Number, page 57, has not, probably, seen a new invention of a mechanic named Davis, which surpasses all others. His gun is so constructed as to have the whole of the lock (except the cock) concealed, which renders it completely waterproof, and prevents any part of the copper cap from endangering the

loss of an eye, as is the case with the Carmarthen guns. The cap, too, explodes *quite* at the end of the breech, and having neither an angle nor an oblique direction for the fire to pass, but lighting immediately behind, and, consequently, having the *whole* body of the charge before it, the recoil, so much complained of in other guns, is prevented. Your readers may judge for themselves, by applying at Blanch's, the gunmaker's.

The readiness with which you give publicity to every new invention, convinces me that your object is to see true merit duly appreciated, and it is therefore I have been induced to trespass thus far on your valuable columns.

I remain, Sir,
Your old Correspondent,
TELLOC TRIGGER.

STATE OF CIVIL ARCHITECTURE.

SIR,—Your Correspondent "Omega," having shown much frankness in his able refutation of the article in the Journal of Science, I trust he will peruse with the same feelings the few observations which I am about to offer upon his letter. It is not my intention to state any thing in opposition to his remarks upon *Naval* Architecture, but to those upon Civil Architecture, which appear to have been written in error, rather than in the spirit of error.

Omega states, that civil architecture has not made any advancement since the time of the ancients, and thinks "Alpha" to be the first person who would lead men to perfect experience by the study of theory alone (probably he is). Allow me, Sir, to say, that *he* appears to represent *both Alpha and Omega*, when speaking of civil architecture, in the manner he has lately thought proper to do.

I would ask him, in the first place, (speaking of what he considers architectural design), what is invention? or whether there is any such thing in the present day as real invention? All the arts have arisen either from necessity, or from observation upon the works of nature; and "the same images and incidents, with little variation, have served all authors who have ever written," and all men who have ever thought. Having formed this opinion, it appears to me, that what we *now* call *invention*, is more properly imitation (or the selecting and modifying to our several purposes those things which are already in a state of entity). We require *no new Orders* in architecture—they are already sufficiently numerous; it is *the just appropriation of these Orders* which we require, and which Omega may find has already been done, in almost innumerable instances, in the metropolis and its environs. Let him visit that part of the metropolis in which improvements are at present being carried on, and if he really is unprejudiced, respecting the comparative merit of ancient and modern architects, he will behold stately edifices, equalling the productions of the ancients, and of which any country would have reason to boast.

If Omega take any work representing the temples of Greece, he will find them generally of a parallelogramic form, one of the most simple that geometry affords. The constructive parts of these temples accorded with the plan, and the chasteness pervading the whole attracted the attention, and lulled the mind into a state of perfect serenity, the most proper for meditation. Among the Romans, it is true, construction appears rather in a superior light; yet we may perceive, that architecture was considered by them more an ornamental than an useful art. Without preserving the purity of the Grecian style, they introduced a profusion of embellisment, which presenting no relief, tended rather to tire than satiate the eyes of the beholder. Most of their edifices were for religious, triumphal, or theatrical purposes, and did not, therefore, offer that diversification of plan which is necessary in works of a more domestic kind. The invention of the arch has been ascribed to them, but with how much reason, is a matter of doubt. The indefatigable and lamented Belzoni discovered in Egypt what he considered to have been the origin of the arch; and should we feel unwilling to award *that country* the merit of invention, *Greece, as an intermediate claimant*, stands forth to assert her rights. It was seldom used by the Grecians, but this may have arisen from an idea of its producing an effect contrary to the sublime, and not from any inability or ignorance as to its application. We must, however, allow the Romans great merit for the use which they made of this important auxiliary in constructive architecture; but we must, at the same time, attach blame to them for its abuse: its application was at first very confined, but it continued to increase until there was scarcely an aperture to be seen in which it was not introduced. I cannot omit stating my surprise, that Omega should have considered *vox populi vox Dei*. Had he not done so, and had he not been prejudiced against modern architecture, he would never have adduced the *beauty* of the steeple of Langham-place Church, or the *stability* of the Custom-house, as

criteria of the state of practical experience among its professors. I shall make very few other remarks upon his letter, but I am sorry to find he has got hold of the common but erroneous opinion, "that so many eyes cannot but see right, and so many understandings cannot be deceived." With respect to the Custom-house, I can assure him, that he who makes his decision upon a matter without having heard *both* sides of the question, will be considered far from just, even should it happen to be correct.

I daily, and almost hourly, hear of the decline of civil architecture; and *if those who have the power and influence to cherish one of the most useful and important of the arts, are altogether indifferent about it, we cannot be surprised* (when such persons render it unworthy the attention of the ingenious) *if carpenters, auctioneers, and others, assume to themselves the enviable but misplaced title of architects.* Every art depends upon public patronage, and if civil architecture is yet to keep up its character, it can only do so under the superintendence of those who are willing to sacrifice their health and property to its advancement; and who, disdaining the mere acquirement of filthy lucre, seek to obtain a niche in the temple of Fame, to have the laurel of assenting Time awarded him, and be handed down to posterity with a Jones, a Wren, and a Stuart, as ornaments of their profession, and benefactors of their country.

I remain, Sir,
Your constant reader,
KAPPA.

BACKS OF STOVES.

SIR,—Your Correspondent, "T. Hartshorne," No. 88, page 60, of your valuable Magazine, is in error in supposing that the practice of having the inside backs of stoves perforated at certain distances is obsolete. There are scarcely any stoves, except the very common sort, without them (I always use them myself). He is likewise wrong when he says that these holes prevent the back breaking, by allowing it to expand. The only way in which they have a good effect is, that they prevent the back from cracking a greater distance at any one time than from one hole to another. If T. H. thinks the main back should have holes in it, I must differ from him, and consider it a very dangerous plan, and not at all likely to be revived. I never saw one of that description myself. Perhaps he mistakes the false back for the outer or main back.

I am, Sir,
Yours very truly,
A STOVE-MAKER.

May 3rd, 1825.

PROFIT AND DISCOUNT.

SIR,—In your 87th Number, p. 35, I find an article purporting to be on the same subject to which the rules relate that I some time ago forwarded to you, and which were published in page 342 of your 78th Number.

Your Birmingham Correspondent has condescended to adopt the example given in your 78th Number, in order to show that the rule there used does not produce a correct answer. If you will refer to my paper, you will see that I assert $CR+C$ is equal to $S-SD$, or, in words, that the cost price added to the cost price multiplied by the rate per cent. of profit, is equal to the difference between the sum sold for and the product arising from multiplying the sum sold for by the rate per cent. of discount; or, as it may accommodate the "Old Manufacturer," we may say, that the cost price added to the profit is equal to the selling price, less the discount: and here I take my ground.

The "Old Manufacturer," after volunteering to plead the cause of "common sense," happens to introduce the letter N, to represent what he calls the nett amount, apparently without being aware that the amount of cost and profit is truly denoted by $CR+C$, or $S-SD$, and not by $N+NR$, as erroneously stated by the "Old Manufacturer."

The "Old Manufacturer" may not, perhaps, object to take a lesson from Walkingame, one of the descendants of Old Cocker, whom I, therefore, prefer to Francis Walkingame, the schoolmaster. In the "Tutor's Assistant," by Francis Walkingame, page 67, it will be found that the old schoolmaster says—"If a parcel of cloth be sold for 560*l.* at 12 per cent. gain, the cost price was 500*l.*" This is the fourth question in page 67, and, from its being in whole numbers, may be some recommendation to the "Old Manufacturer." I, as above stated, say that $C+CR$ is the amount of cost and profit: now let us see whether that expression $C + CR$ will accord

with the old schoolmaster's account. C represents the cost prices, or 500*l.*; and R represents the rate per cent. of profit, or 0.12; therefore, by having recourse, as the "Old Manufacturer" expresses himself, "to pure or unmixed mathematics, viz. plain arithmetic," I find that 500*l.* the cost price, added to 500*l.* multiplied by 0.12, will just amount together to 560*l.*; and that 560*l.*, the answer by my rule, is really as much, and no more, than the amount of cost and profit, or the selling price, which the old schoolmaster talks about.

I find that the "Old Manufacturer" says, at the bottom of page 35 of your 87th Number, N—NR is equal to C, or the cost price. Let us now see how this agrees with Walkingame. N now represents 560*l.*, and R represents 0.12.

First put down N=560*l.*
then NR is equal to 560 x 0.12= 67*l.* 2*s.*

therefore 492*l.* 18*s.* now turns out to be the cost price, which happens to be less than 500*l.* by 7*l.* 2*s.*

Walkingame says the cost price is 500*l.*; the "Old Manufacturer" says it cost him but 492*l.* 16*s.*—Is Walkingame right, or is the "Old Manufacturer" right?

I shall now put the "Old Manufacturer" to the trouble of following me in revising his result as to the alleged error in the example given by me in your 78th Number.

"To illustrate," he says, "suppose I sell goods which cost me 80*l.* for 100*l.*, my profits are one-fifth, or 20 per cent., and my cost four-fifths, or 80 per cent., the five-fifths being the whole, or the centum."

Now, unless the collected wisdom of the "Old Manufacturer," and the "Constant Reader," both good and true men of Birmingham, be quite able to upset all the descendants of Old Cocker, every sane man in England will conclude that, if 80*l.* be increased by profit to 100*l.*, the increase, profit, or gain, must be 25*l.* per cent. on the capital employed.

Let us conclude this nonsense with what may serve as rather a better specimen still. The "Old Manufacturer" says, that whatever the article may yield which cost him *nothing*, he should consider to be *all profit*, or *cent. per cent.!!* The "Old Manufacturer," by selling an article for half-a-crown which cost him *nothing*, is content to gain cent. per cent.!!!

I beg one more moment for his attempt to pervert the correct result given by me in your 78th Number, page 342; he applies my result to the torture, by applying his *false rule*, N—NR = C. He has committed a blunder either in subtraction or multiplication, in "pure unmixed mathematics, viz. common arithmetic," as he calls it. He says that 55.412 — 55.412 x .03 = 52.445; but it is clear that 55.412 — 55.412 x .03 = 53.649. He goes on with this blunder to the end, without even once acknowledging that the erroneous result, which he supposes he has shown, arises from his applying a rule quite dependent on a whim of his own, and which could not prove whether my answer were correct or not, even if the blunder above mentioned had not been committed. My answer is correct, and my rules are correct.

Perhaps I shall take the trouble of analysing the other fallacies which this Birmingham "Old Manufacturer" has attempted to put off as sterling "common sense," and forward the result for your valuable miscellany.

I am, Sir,
Your obedient servant,
M. W.

Fenchurch-street, 30th April, 1825.

THE "SHOP-DOOR ALARUM-BOLT."

Sir,—Your Correspondent, F. H., in page 56, No. 88, of your most useful work, has given the drawings of what he calls a simple contrivance for a shop-door alarum-bell. Now, in my opinion, nothing of the kind can be more complex than this plan of his. Bell-hangers have very long been in the habit of using, for this purpose, a drop lever crank, which is fixed on the door-post, and acted upon by a simple bolt on the door, and costs about one-sixth the sum which I think F. H.'s contrivance would; besides, if I am correct in the view I take of it, the bell would ring upon the *shutting* as well as upon the opening of the door—an annoyance which is avoided by the simple lever crank I speak of.

Another kind of shop-door alarum is a clock-bell, acted upon by a drop lever with a hammer head, which strikes upon *opening* the door *only*,

and is much more simple than your Correspondent's alarum-bolt. If he had applied to a bell-hanger, he would have received the information I now give him; if he is himself a bell-hanger, I should be happy to show him both these alarum-bells in use, by his giving his address.

I am, Sir,

Yours, very truly,

A Bell-Hanger.

9th May, 1825.

SAWING TIMBER.

Sir,—I request the insertion of the following statement in your valuable little work. My object is to bring to public notice a most unjust practice among a certain class of men (which, by-the-bye, I am told is law). I withhold names, because it is not persons, but things, which I wish to expose.

I lately bought a piece of squared oak timber of a most respectable merchant, and had it sawed at his yard. The charge for so doing was one pound eight shillings and eleven pence, which appeared to me, at the time I was settling the bill, to be far too much; but being told, in the counting-house, that it was correct, I paid it.

On receiving my purchase I very carefully measured the work, which was as under:—

Plank	2 Crosscuts.	
	7 Cuts, each 7 feet 4 inches long × 19 inches	= 81 feet.
	6 Cuts, each 7 feet 4 inches long × 16 inches	= 59 feet.
Scantling	2 Cuts, each 14 feet 8 inches long × 17 inches	= 42 feet.

Finding there were not two hundred feet of sawing altogether, I sent for an explanation, and was again told, at the counting-house, that the charge was perfectly correct—that their men sawed by the load, not by the hundred—that, as there were seven cuts in one piece, they could legally claim for the same number in all three pieces—that it was at my option to have had them all sawed in the same way, and then the charge would have been no more.

This sawyer's logic, however, is not satisfactory to me; for although it is my anxious wish that every journeyman should be fairly and liberally paid for what he does, yet I see no reason in paying for what has not been done. But if this is the regular London custom in the great timber-yards, it appears to me to be "a custom more honoured in the breach than in the observance," and that it is time it was done away with.

However, Sir, if you will have the goodness to insert the above in your Magazine, it may cause some other buyers to make previous inquiry respecting the charge for sawing before they give orders for its being done, and thus avoid an addition of more than five per cent. in price to them, as has been *once* done by,

Sir, yours respectfully,

A Brother Chip.

P.S. It may not be altogether unnecessary to add, that the method of computation at this timber-yard was three cuts for a load, at ten shillings and sixpence per load.

A ROMAN BREAKWATER.

Pliny, in one of his Letters, says—"I received lately the most exquisite entertainment imaginable, at Centumcellæ (supposed to be Civita Vecchia). This delightful villa is surrounded by the most verdant meadows, and commands a fine view of the sea, which forms itself here into a spacious harbour, in the figure of an amphitheatre. The left hand of this port is defended by exceeding strong works, as they are now actually employed in carrying on the same on the opposite side. An artificial island, which is rising in the mouth of the harbour, will break the force of the waves, and afford a safe passage to ships on each side. For the construction of this wonderful instance of art, stones of a most

enormous size are transported hither in a sort of pontoons, and being thrown one upon the other, are fixed by their own weight, gradually accumulating in the manner, as it were, of a sand-bank. It already lifts its rocky back above the ocean, while the waves which beat upon it, being tossed to an immense height, foam with a prodigious noise, and whiten all the sea around. To these stones are added large piles, which in time will give it the appearance of a natural island. This haven is to be called by the name of its great author (Trajan), and will prove of infinite benefit, by affording a very secure retreat to ships on that extensive and dangerous coast."

METALLIC ROOFING.

SIR,—I have only this day seen the 28th Number of the Mechanics' Magazine, or I would have replied earlier to the letter from Sheffield, signed R. S. T. (page 412, vol. III.) The gentleman to whom I alluded in my last letter, as the possessor of the Metallic Roofing, is Mr. Edward Garbett, of Reading, architect, who will, no doubt, give R. S. T. any information on the subject he may desire.

At the same time I will answer "A Subscriber's" inquiry in page 404, and tell him that the church I mentioned as being so beautiful, is Theale Church. It may be seen in passing from London to Bath, about five miles below Reading, on the right hand side of the road; and it was built by Mr. Edward Garbett, who seems to inherit the pure and classic taste of his father, Mr. Garbett, of Winchester.

St. George's Church, at Birmingham, lately built by Mr. Rickman, of that place, in the decorated English style, is another delightful specimen, which, in these days of church-building (and such churches, too!) is quite refreshing to look upon.

In looking at such buildings as Theale and St. George's, one cannot but lament that architects do not more frequently content themselves with compiling from the best examples, as Mr. E. Garbett and Mr. Rickman have done, instead of forcing upon us "their own inventions."

I am, Sir,
Your obedient servant,
ABEL HANDY.

May 3rd, 1825.

DURHAM MUSTARD.

There are, probably, but few individuals now living acquainted with the history of the manufacture of Durham mustard. Prior to 1720 there was no such luxury as mustard, in its present form, at our tables. At that time the seed was only coarsely pounded in a mortar, as coarsely separated from the integument, and in that rough state prepared for use. In the year I have mentioned, it occurred to an old woman of the name of Clements, resident at Durham, to grind the seed in a mill, and to pass the meal through the several processes which are resorted to in making flour from wheat. The secret she kept for many years to herself, and, in the period of her exclusive possession of it, supplied the principal parts of the kingdom, and in particular the metropolis, with this article; and George the First stamped it with fashion by his approval. Mrs. Clements as regularly twice a year travelled to London, and to the principal towns throughout England, for orders, as any tradesman's rider of the present day; and the old lady contrived to pick up not only a decent pittance, but what was then thought a tolerable competence.—From this woman's residing at Durham, it acquired the name of Durham mustard.

J*****.

CHINESE SHEET LEAD.

This article is manufactured by two men; one is seated on the floor with a large flat stone before him, and with a moveable flat stone-stand at his side. His fellow-workman stands beside him with a crucible filled with melted lead, and, having poured a certain quantity upon the stone, the other lifts the moveable stone, and

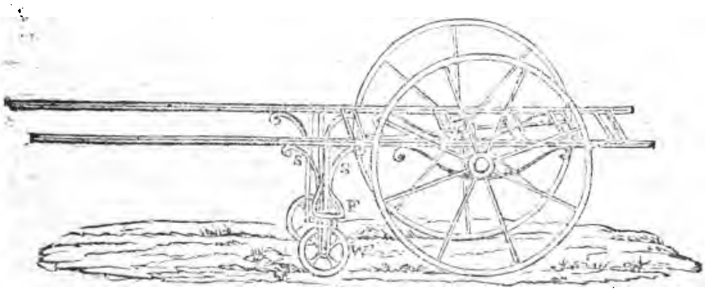
dashing it on the fluid lead, presses it out into a flat and thin plate, which he instantly removes from the stone. A second quantity of lead is poured in a similar manner, and a similar plate formed, the process being carried on with singular rapidity. The rough edges of the plates are then cut off, and they are soldered together for use.

Mr. Waddell has applied this method, with great success, to the formation of thin plates of zinc, for galvanic purposes.

COMMON WAX OR VARNISHED CLOTH.

The manufacture of this kind of cloth is very simple. The cloth and linseed oil are the principal articles required for the establishment. Common canvas, of an open and coarse texture, is extended on large frames, placed under sheds, the sides of which are open, so as to afford a free passage to the external air. The manner in which the cloth is fastened to these frames is as follows: It is fixed to each side of the frame by hooks, which catch the edge of the cloth, and by pieces of strong packthread passing through holes at the other extremity of the hooks, which are tied round moveable pegs in the lower edge of the frame. The mechanism by which the strings of a violin are stretched or unstretched, will give some idea of the arrangement of the pegs employed for distending the cloth in this apparatus. By these means the cloth may be easily stretched or relaxed, when the oily varnish has exercised an action on its texture in the course of the operation. The whole being thus arranged, a liquid paste, made with drying oil, which may be varied at pleasure, is applied to the cloth.

PLANS TO PREVENT CARRIAGES FROM FALLING.

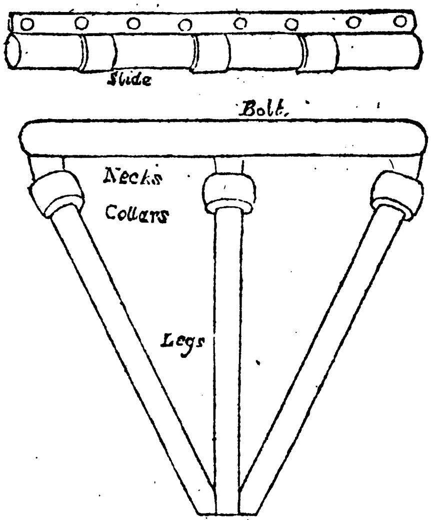


SIR,—In the Third Volume of the Mechanics' Magazine, No. 59, page 40, there is a method for raising *fallen* carriages; I now beg leave to offer a plan to *prevent them from falling*. By this plan the carriage would appear more finished, and the shafts would be greatly supported; by it, too, the horse would have but little weight to carry, and the carriage would stand more level, and be much easier yoked and loosed. The support may be either of wood or iron, and firmly attached to the shafts with iron. The wheels on the under side are one foot four inches high, either of cast iron or of wood, well shod with iron. F is the foot-step. SS are the supports; W, the wheels. The support is bent out, to make the little wheels run in the same track as the large ones.

I am, Sir,

Your humble servant,

DIXON VALLANCE.



SIR,—In the 59th Number of your useful Magazine, I read of a method, suggested by "E. W.", for raising fallen two-wheeled carriages, which I think will answer extremely well; but I submit that it would be better if we could prevent carriages from falling at all. Your Correspondent believes that it is out of the power of any one to prevent horses from falling, and I agree with him in that respect; but I contend that carts may be supported and kept from falling, if horses cannot; and I dare say that gentlemen will not be offended with me if I suggest a method by which it can be done, with little expense and much advantage. Let a plate of iron be cast about six inches or more in length, and bent to take the shape of the shaft, having several holes in it for the purpose of nailing it to the shaft, with a strong slide in the centre (lengthways), and similar in make to the slide of a door bolt, having a slit close against the plate, extending from one end to the other, and likewise three perpendicular divisions for the legs to fall between. The next things to be described are the bolt and the legs. The bolt must be of the same length as the slide, and made to fit so close that the weight of the legs shall not weigh it down. Let the bolt be cast with three collars, the two end ones inclining towards each other, with strong short necks between them and the bolt, so that when the wood work is put to the iron, the whole will form a triangle. I propose that one shall be applied to each shaft, for one will not be strong enough. The collars, of course, must be made strong, as they will not only have the weight of the cart and jerk, but also the weight of the horse for a moment, but no longer; for, as soon as the horse finds the weight off his back, he will rise without the help of either carman or spectator. Now, as I am aware there will be objections to this method, I shall notice one or two of them. The first is this:—

The cart not always being level with the horse, it will be said that these legs will frequently be in the way when travelling along a rugged road; and that, when the wheels of the cart are sunk in hollows, or the horse on high ground, the legs will either impede the progress of the horse or break short off. This would be the case if the legs were not moveable, but, being so, it is impossible, if the carman pays the attention required, which will only

be, at such a time, to move the legs under the shaft towards the belly of the horse, or take them off altogether.

The next objection will be the appearance; but, in carts for conveying burdens, elegance is not consulted, but utility alone. The legs will neither be in the way of the carman nor the horse, but, in case of accident, will prove fortunate to them both.

I am, Sir, yours, &c.

A Goldsmith's Apprentice.

No. 14, Frith-street, Soho,
Westminster.

STEAM CARRIAGES.

It is stated in an article of news from Copenhagen, inserted in all the newspapers, that Matthew Broemark, a learned Danish Mathematician, has invented a new Steam Carriage, which "can be easily guided, and travels at the rate of fourteen leagues an hour!!!" The first experiment, we are told, "was made sixty leagues from Copenhagen. The carriage, loaded with passengers, set out at half an hour past eleven from the place where it was built, and arrived at the gates of Copenhagen at a quarter before five." M. Broemark, it is added, intends paying a visit in his carriage to Paris. We hope he will cross the Channel before his return home, and afford us ocular evidence of what, we must confess, appears to us at present rather an exaggerated statement.

A steam carriage has also been launched in the United States, which does wonders, though nothing like what is reported of M. Broemark's machine. The following account of it is given in a letter from Edgar Court-house, Illinois:—

"I have had the pleasure, with fifteen or twenty other gentlemen, of viewing and closely examining a large model of a steam carriage, lately invented and put in operation by Mr. T. W. Parker, of Edgar county, Illinois, late of Vincennes; and it is the opinion of all who have examined it, that it cannot fail to operate well, and that there is apparently no fault to be found with it. Mr. Parker has sent to Washington city for a patent.

"I shall attempt to give a short description of this carriage. It runs on three wheels, two behind and one in the centre, which wheels, with their axles, are united together by slip-sleeves, which, in turning, can be slipped out or in at pleasure, and by the fore wheel can be steered remarkably easy, with a windlass similar to that of a ship. This carriage is very simple in every part, and very light. The construction of the engine is altogether new, and the power is given by a double cylinder, with pistons working at both ends, which are attached to the crank of the fore and after wheels. The cylinder is supplied by a tort, about as large again as as the cylinder, which is made of copper or cast iron, and which is placed in a small air furnace. The tort is supplied by a forcing-pump and a copper pipe, running through the tort, perforated with holes of the size of a small needle, or about sixty to a square inch. At every motion of the forcing-pump, there is a small quantity of water forced from this pipe, and is immediately converted into steam (the tort being very hot), which passes from the tort to the cylinder.

"Mr. Parker gives it as his opinion, that a carriage of 20 tons burthen will not require more than 20 or 25 bushels of good coal per day; and that 300 gallons of water will produce 30 revolutions each minute on an eight-feet wheel, at which rate the carriage will travel, on good turnpikes, upwards of 200 miles a day. One man and a boy will be sufficient to tend upon a carriage of this kind; and they can be made light for pleasure carriages as well as for burden. This carriage will perform her duty without the aid of the European rail-roads, on any good turnpike-road, and will be completely manageable up hill or down."

Dr. Buchanan, whose capillary steam-engine we noticed at p. 360, has also been labouring to apply it to the propelling of land carriages. "The experiment," says a New York paper, "has been made, and the Doctor has moved the carriage three or four miles. But for some disproportion in the machinery, it is said, the experiment would have been completely successful."

IMPROVED PROCESS OF HARDENING STEEL.

(From Nicholson's Operative Mechanic, just published.)

Articles manufactured of steel, for the purposes of cutting, are, almost without an exception, hardened from the anvil; in other words,

they are taken from the forger to the hardener, without undergoing any intermediate process; and such is the accustomed routine, that the mischief arising has escaped observation. The art of forging produces a strong scale or coating, which is spread over the whole of the blade; and, to make the evil still more formidable, this scale or coating is unequal in substance, varying in proportion to the degree of heat communicated to the steel in forging; it is, partially, almost impenetrable to the action of water, when immersed for the purpose of hardening. Hence it is that different degrees of hardness prevail in nearly every razor manufactured: this is evidently a positive defect; and, so long as it continues to exist, great difference of temperature must exist likewise. Razor blades not unfrequently exhibit the fact here stated in a very striking manner: what are termed clouds, or parts of unequal polish, derive their origin from this cause, and clearly and distinctly, or, rather, *distinctly*, though not *clearly*, show how far this partial coating has extended, and where the action of the water has been yielded to, and where resisted.

It certainly cannot be matter of astonishment that so few improvements have been made in the hardening of steel, when the evil here complained of so universally obtains, as almost to warrant the supposition that no attempt has ever been made to remove it. The remedy, however, is easy and simple in the extreme; and so evidently efficient in its application, that it cannot but excite surprise that, in the present highly improved state of our manufactures, such a communication should be made as a discovery entirely new.

Instead, therefore, of the customary mode of hardening the blade from the anvil, let it be passed immediately from the hands of the forger to the grinder; a slight application of the stone will remove the whole of the scale or coating, and the razor will then be properly prepared to undergo the operation of hardening with advantage. It will be easily ascertained that steel, in this state, heats in the fire with greater regularity; and that, when immersed, the obstacles being removed to the immediate action of the water on the body of the steel, the latter becomes equally hard from one extremity to the other.

To this may be added, that, *as the lowest possible heat at which steel becomes hard, is indubitably the best*, the mode here recommended will be found the only one by which the process of hardening can be effected with a less portion of fire than is or can be required in any other way.

These observations are decisive, and will, in all probability, tend to establish in general use what cannot but be regarded as a very important improvement in the manufacturing of edged steel instruments.

WOODEN CHURCH CLOCKS.

Sir,—Being lately at a clockmaker's shop, and inquiring the price of a large turret or church clock, I was informed it varied from sixty pounds to six hundred. This appearing to me an enormous sum, it occurred to me whether it was possible to substitute wooden clocks in particular cases for those of iron, especially for village uses. This appeared to me possible, as the common wooden or Dutch house-clock keeps as good time, for domestic purposes, as a brass one; but, never having heard of a wooden clock of any magnitude, I would beg any of your Correspondents to decide on the utility of such an article of mechanism, and to state the objections, if any; for, if few, these articles may probably be brought into use, where, from the great expense of those of metal, many villages and small towns are utterly destitute of that valuable public and private regulator.

I remain, Sir,

Your constant reader and well-wisher,

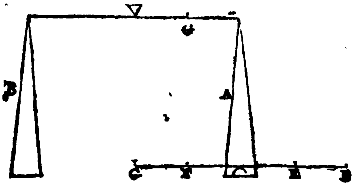
Vittoria.

March 1st, 1825.

THE BALANCE QUESTION.

Sir,—I am one of the "two persons" alluded to by C. Eagland, in No. 76, page 307, of your work; and he failing (as he says) to convince me of the truth of his theory, *dared* me subsequently to answer his letter, otherwise I should not have attempted such a thing, for fear of cutting but a poor figure in print; but should I answer him "properly," in a mechanical sense, I trust all "faults of style" will be excused.

If a deal plank be placed in scale A, with or without a fulcrum, as in the following diagram, and poised with a weight in scale



B, and weights, say 20 stone, be placed on the plank at each of the points, C and D, to poise each other, 40 stone in scale B will balance the whole. But if, instead of the 20 stone at point C, a man of 12 stone stands, pressing upwards under the fulcrum, with a power of eight stone, he will restore the equilibrium of the *plank and beam*, with 40 stone opposed to 32. If the weights are removed from D to E, and the man to F, pressing at point G of the beam, the same power will produce only half the effect, and at all other parts of the beam in proportion, on the well-known principles of the lever, *without* forcing the scale "*obliquely outward*," or "*elongating that arm of the beam*."

The same effect may be produced by fixing a pulley to the cieling over the beam, and another to the floor under the scale, with a cord tied to the beam, passing round the pulleys, and through a hole in the centre of the scale, for the man who stands in it to pull by.

I am, Sir, yours, &c.

J. B.

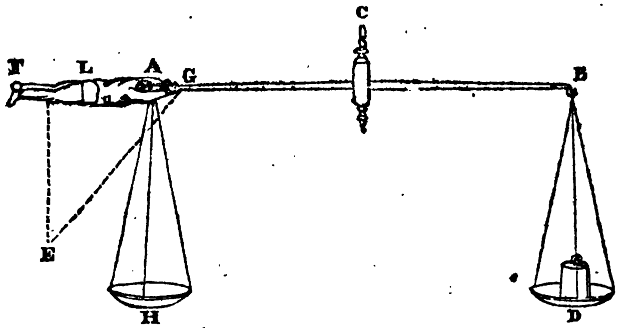
Sir,—Although I have been a subscriber to your interesting and valuable Publication from the beginning, yet as my bookseller sends it to me in parts, two or three at a time, I have only recently noticed the various communications of your different Correspondents upon the subject of the apparently singular property of the Balance, first alluded to by C. D., page 224. It has often struck me as unaccountable, but I never paid much attention to it till I observed it noticed in your Magazine. A little reflection, however, solved the difficulty, and I purposed sending you my solution of it, when I observed the letter of your Correspondent, G. B., page 234, which before had escaped my notice. His explanation perfectly corresponds with that which I had intended to have given; I should not, therefore, have troubled you, but from one or other more recent communications, which deny its correctness.

And, first, I will make one or two observations on the letter of S. Y., page 278. It is evidently written by a *young* engineer; one more experienced *would have advanced* a more plausible explanation of the property in question before he had so intemperately opposed G. B. I confess that I see nothing in the style of the latter which warranted such language. It is not in this way that science is promoted. I, however, maintain, that the reason assigned by G. B. is the cause of the effect mentioned. I dare say, G. B. never supposed that a pressure, however great, exerted in the way S. Y. describes, would increase the actual weight; but still, in proportion to the pressure, will the scale preponderate more or less. It always gives me much pleasure to read the communications of such Correspondents as C. Eagland, page 307; his letter forms a pleasing contrast to that of the young engineer. But it will be found from experiment, that the pressure exerted by a person in the scale against the beam is not sufficient, in its reaction upon the scale, to throw it so far out of the perpendicular as to produce so great a preponderance. In fact, the pressure may be made in such way as not to produce this effect in the slightest degree; for let it be exerted against a fixed object to the same degree, in the same direction, and the effect will not be produced. It appears to me, that the reason assigned by G. B. is sufficient, and philosophy teaches us not to multiply causes. If I press upwards with a force of six pounds, this force is also exerted in a downward direction—action and reaction being equal and contrary. Now, supposing half the beam to be two feet, and that I press at the centre of this, it is evident that my downward pressure is, at the end of a lever, of twice the length

of that upon which the upward pressure is exerted; the preponderance follows of course. I do not know if I have made my explanation sufficiently clear, but it will be seen that it coincides with the view taken of it by G. B.; and if you think it worthy a place in your Magazine, I shall feel happy to have been a contributor.

I am, Sir,
Your obedient servant,
A Constant Reader.

Sir,—As a subscriber from the first commencement, and well-wisher to your very useful work, the "Mechanics' Magazine," I beg to offer it as my opinion, that the solution of the Balance Question, given by Mr. George Gregory, page 361, is founded on fallacious principles, and in what manner, I will endeavour to elucidate. Mr. Gregory writes with the technicality of a scientific mechanic, and I am therefore quite surprised to see him overlook in his position one of the first laws of the science, viz.—the line or centre of gravity.



Description.

The letters ABCDEFGH, as above, bear reference, in a measure, to Mr. Gregory's solution also.

If the point of suspension, A, be mechanically lengthened by the oblique direction of the man, to the full extent of his body in the scale, H, which would be at E; and supposing him to have forced himself completely horizontal with the beam, as GF, his preponderance of weight must have increased as the beam was lengthened by his body to F, thereby destroying the well-known axiom, that the centre of gravity is always under the point of suspension; by which law, allowing the man's height to be six feet, the point of suspension would be extended to about three feet, or to letter I.

This equally answers the question as stated in page 224.

I am, Sir,
Your obedient servant,
Wiltshire. F. J. M.

Sir,—If I were to suppose myself capable of carrying conviction to the minds of those who are predetermined to reject without examination, and condemn as absurd, every opinion opposed to their own, I should, indeed, deserve the title of "presumptuous;" but I beg to inform James Yule, and your readers in general, that I do not write for the purpose of making particular individual converts to my opinions, but merely to state those opinions, and the reasons why I entertain them; having done this, I conceive I have done enough. Those who are interested in the matter on which I write, will, of course, consider every thing they read or hear on the subject which is worthy of consideration. If they find my reasons good, they will most likely adopt my opinions; and if they deem other opinions better supported, I should be very sorry if they adopted mine. This is all the answer I mean to give J. Yule's attack upon my paper on the balance question. S. Y.

21st April. (*A Young Engineer.*)

P.S.—Railways.—Mr. Yule likewise disputes what I have advanced on Railways. I mean also to leave that paper to its fate; but I beg to inform that gentleman, that the question put to him in page 394, was sent to you previous to my writing the paper on railways, although the last-mentioned paper was first published; and as to my knowledge of the experiments of Vince and Coulomb, I candidly tell him, I know nothing more of them than what is published in Gregory's Mechanics; in which work I observe (vol. II. p. 21, third edition), "it was concluded, that the friction of hard bodies in motion is a uniformly retarding force;" and this is what I have supported; and, to prevent misunderstand-

ing, I now assert what I before insinuated, that the above conclusion does *not* support the inferences drawn by the writer on railways in the *Scotsman*. I shall feel very much obliged to Mr. Yule if he will inform me in what publication Professor Vince asserts, that "friction is always corresponding to the time." (See Mechanics' Magazine, vol. III., page 438.)

MEASURE OF FORCE FOR PERFORATING METAL AND OTHER SUBSTANCES.

Sir,—The measure of the force necessary to punch a hole through a plate of metal or other substance, may, perhaps, be interesting to some of your readers. I shall, therefore, trouble you with the result of some experiments made on that subject.

I had a good cylindrical steel punch made, and fitted to a guide or director, so as to move correctly to a cylindrical hole in a steel plate connected with the guide; with this instrument I was able to force cylinders of metal very uniform, and with little or no bur to the hole, both by simple pressure and by percussion.

The results of some experiments made on the force of simple pressure, to make a hole through a metal plate of one-eighth of an inch in thickness, and one-fourth of an inch in diameter, are as follows:—

Plate iron........	3900 pounds.
Cast brass........	3200
Hammered brass..	3600
Copper	2800

The following are the results from the same machine, on specimens of wood, in the direction of the grain, of the same thickness and diameter:—

Christiana deal....	135 pounds.
Mahogany	170
Dry box wood	356
Beech	204
Ash	197
Oak	156
Elm	122

I am, Sir,
Your obedient servant,
B. Bevan.

PURIFYING OIL FOR WATCHMAKERS.

Sir,—Many processes have been recommended for purifying the oil used by watchmakers: A sand bath, washing it, boiling it, and exposing it to the sun in summer (as recommended by your Correspondent, p. 197, vol. III.) I must beg to say, however, that, by washing, oil is not to be freed from that intermixture which is injurious to the movement or the going of a watch; neither can it be purified by the application of heat.* Oils are, more or less, adulterated with gummy or watery particles, which cause the oil, when applied in small quantities, to dry on the plates like gum, or turn into rust: this I have found the cause of many good clocks and watches stopping. I have had clocks that have gone until the pinions have been worn to a thread by the friction caused by the rust. Sweet oil contains more impurities than the almond, and almond more than the olive. The best I could ever find for delicate machinery was the olive oil, and the way I purify it is as follows:—I put into a white glass bottle three parts of oil to one of spring water, shake them well together, and expose them to *the frost*. The water promotes the freezing of the impure particles in the oil, when the bottle may be turned upside down, and that which I consider to be the best oil will drain from the bottle.

I am, Sir,
Yours respectfully,
M. Monnom,
Broadway. Watchmaker.

MR. DOWDEN'S GEOMETRICAL CONSTRUCTION.

Sir,—Permit a Tyro in Mathematics to observe, that the geometrical construction, given in your 89th Number, of a parallelogram, said to equal the circle, does not correspond with the trigonometrical calculation there given. The per-

* This is somewhat absolute, especially after *the fact* stated by our Correspondent, page 198, volume III.—Edit.]

pendicular height of the parallelogram, according to the construction, is the radius added to the tangent of $30^{\circ} = 1.5773503$, and the area is 3.1547006, instead of 3.1415926, the area of the circle. The segment cut off by the construction will be found only 109° 28′, instead of 110° 23′, neglecting seconds.

I am, Sir, yours, &c.

N. H.

INQUIRIES.

NO. 120.—EFFECT OF DEPTH ON THE QUALITY OF WATER.

SIR,—Can any of your Correspondents inform me, through the medium of your Magazine, whether water is softer at one hundred yards deep than it is at eight or ten yards deep? I understand this is the case at Leeds; and that, for the use of steam-engines, they shut the top water off, and bore from eighty to one hundred yards, in preference to going to the river. I wish to know whether this applies generally, or only to particular situations, as Leeds, for instance.

Also, What is best, for steam-boilers, to soften water?

I am, Sir,

Your most obedient servant,

G. C. E.

Loughborough.

NO. 121.—COMPARATIVE STRENGTH OF MALT AND SUGAR.

SIR,—Will you allow me, through the medium of your pages, to make an inquiry relative to a subject which interests every man who brews his own beer—I mean the comparative strength of Malt and Sugar. The basis of all fermented liquors being saccharine matter, I conclude that, when the prices of these articles are such as to render sugar the more advantageous, as regards the quantity of spirit to be obtained for the same sum, there is no disadvantage in using it largely as a partial substitute in the making of beer. If, however, in addition to the information above requested, any of your Correspondents can give further information as to the advantages and disadvantages of the use of it, or refer to works where it may be obtained, I shall be additionally obliged.

I am, Sir,

Your constant reader,

J. S. M.

ANSWER TO INQUIRY.

NO. 97.—QUESTIONS ON GUNNERY.

[*Second Answer.*]

SIR,—The only certain way of computing the charge of powder for a fowling-piece is by weight, and not by the space it occupies in the barrel; and also the *quality* of the barrel should be expressed, for a difference in expansion makes a difference in the quantity required for a charge: for instance, the Damascus and common barrels, on account of their less expansibility than the twisted barrels, shoot equally strong with the latter when the charge of powder is reduced four grains; for it must be obvious to every one, that the shot could not be dislodged with equal force when the sides of the barrel yield to the sudden expansion of the exploded powder; and here I may add, that the shot travels with a much greater velocity than the rarefaction that moved it, which shows that the shot receives no accumulation of force by the quantity of powder which is put into the barrel, more than what is fired in the first instant, as the shot is propelled by the first rush of the air on the combustion of the powder.

The accompanying scale will be found as correct as the latitude of the question will allow. I have formed it for my own use, and I may add without exaggerating, that it is the result of trials made on several hundred guns.

To the second question I can give no answer.

On the third I have to observe, that barrels are not so much distressed by firing balls if the bore is cylindrical; the shot having a tendency to occupy a greater space, and therefore pressing hard against the sides of the barrel. In proof of this, the barrels of the guns used with shot are soon *leaded*, owing to the friction of the shot; but this is not the case when balls are used. The greatest objection, however, to the use of barrels of fowling-pieces for ball-shooting is, that they are seldom sufficiently strong in the fore-end to prevent a vibratory motion, in which case the ball is thrown without any degree of precision. A ball of 19 to the pound exactly fits a 5-8ths bore, but a ball of 20 pounds, encircled in a thin piece of leather, is preferable. "Telloc Trigger" is about correct in the quantity of powder for charging it.

Fourthly.—The Damascus barrels are decidedly superior to the stubs twisted, or any other; the metal being stronger in texture, uniting better in welding, having little or no recoil, requiring a less charge of powder, and being more beautiful to the view; but, for a more particular account, see the Sporting Magazine for April, 1824.

"Telloc Trigger's" answer to the reference to contracted breeches is sufficient.

The percussion-lock has every advantage over the flint-lock, namely, there is a less liability of accident by it, not being necessary to prime before loading, and the cock may be always kept on the cap except at the moment of firing, which prevents the gun going off at half-cock; and if the gun is brought home loaded, by taking off the cap (which is the priming), there is no danger of its being fired by the foolishness of servants or others: and it is a fact, known to every observer of the percussion-gun, that they kill at ten yards farther than a flint-gun, and that about one quarter less powder is used for a charge, owing to the complete and instantaneous combustion of the whole charge of powder; and that there is no loss of force through the touch-hole, as in flint-guns; and, also, that they receive the additional strength of the priming.

I am, Sir,
Yours respectfully,
WM. E. WIGHTMAN.

Malton, April 5th, 1825.

Calibre of Barrel.	Charge of Powder for a Flint-Gun.	Charge of Powder for a Percussion do.	Quantity of Shot.	Distance to kill.
5-8 in.	1 dram	$\frac{3}{4}$ dram	$1\frac{1}{4}$ oz.	30 yd
	$1\frac{1}{4}$	$\frac{7}{8}$	do.	40
	$1\frac{1}{2}$	$1\frac{1}{8}$	do.	50
	$1\frac{3}{4}$	$1\frac{1}{4}$	do.	60
11-16	$1\frac{1}{4}$	1	$1\frac{1}{2}$ oz.	30
	$1\frac{1}{2}$	$1\frac{1}{4}$	do.	40
	$1\frac{3}{4}$	$1\frac{1}{2}$	do.	50
	2	$1\frac{3}{4}$	do.	60
3-4	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{3}{4}$ oz.	30
	$1\frac{3}{4}$	$1\frac{1}{2}$	do.	40
	2	$1\frac{3}{4}$	do.	50
	$2\frac{1}{4}$	2	do.	60

CORRESPONDENCE.

Communications received from—Mr. Reader—Ignoramus—C. X.—B. D.—A. N.—G. Smith—A Country Reader—Engineer—Mechanicus—Mark Anvil—Legion—A Member of the Mechanics' Institution—Tutus—A Canadian—W.W.

Stultus writes as if his name and character corresponded. We may probably insert the paper he alludes to at some convenient opportunity; but it will be from a regard to the truth of the case, and not to his indiscreet threats.

Erratum.—Line 7, first column, p. 79, for 53*l.* 8*s.* $2\frac{3}{4}$*d.*, read 55*l.* 8*s.* $2\frac{3}{4}$*d.*

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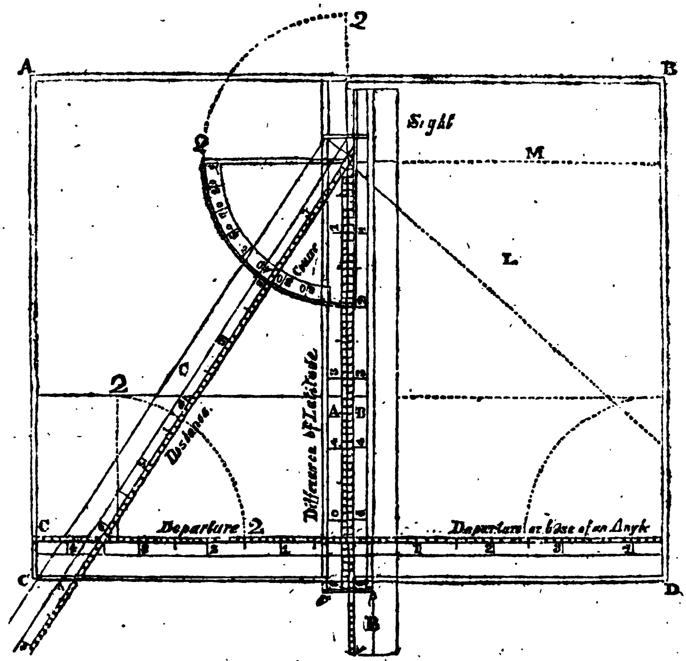
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 91.] SATURDAY, MAY 21, 1825. [Price 3d.

"As the human mind is pleased with the contemplation of what is true, and delighted with the appearance of what is beautiful, it may be assumed that the cultivation of Science, and the improvement of Art, originate in our love of pleasure."—*Ferro on the Fine Arts.*

A QUADRANT AND PRACTICAL NAVIGATOR.



Sir,—I hope you will be pleased to think this newly-invented Instrument worthy a place in your "Mechanics' Magazine." I presume, if it were completely made, it would be found very useful at sea for navigation, as any man might soon understand it; and also for many mechanics and schoolmasters, for demonstrating problems in the highest branches of the mathematics.

I am, Sir, a friend and well-wisher to mechanical sciences; and should this be thought worthy your notice,

I shall be happy to supply you with many of the latest inventions and improvements in this part of the country.

I am, Sir,
Yours, respectfully,
HENRY OGLE,
Schoolmaster, at Rennington, near Alnwick, Northumberland.

Description.

ABCD represent a plain piece of board, with a place in the middle, *pp*, for the slide, A, to move up and down in. Q is a quadrant made fast upon scale B. By enlarging this quadrant to a semicircle, QQ, the scales B and C, turning upon a centre, will set to solve all questions in oblique as well as plane trigonometry. B will turn off from scale A to any distance, as at L, the pricked line; and by sliding A upwards or downwards in the board, the scales will set to the given dimensions of any triangle whatever, and give both the plane and the true contents of all parts at the same time. By raising scale B to the pricked line, M, by a plummet hung at the centre, it becomes a good level; it will also give all the dimensions of a square. If you set slide A to the dimensions of one side of a square, set slide C to the same dimensions in the bottom scale, and C becomes the diagonal of the square. I have solved all the problems of practical navigation by this instrument, and a great number of promiscuous questions, with great ease and accuracy.

N.B. The second horizontal line, C, and that next above it, represent a groove, wherein a quadrant, QQ, slides, divided as the preceding; and by having two quadrants and the four scales to move upon the board ABCD, there will in all cases be three slides and two angles, which, I presume, will solve any question that can be proposed.

DOUGHTY'S RUBY-POINTED PEN.

SIR,—I shall be obliged by any of your Correspondents favouring me with the address of the manufacturer of this article. I purchased one last year, and have found it answer very well; but having had an accident with it, and thinking I could suggest a trifling improvement by a personal communication with the maker, I applied for his address at the shop where I bought it, but was told by one of the partners that it was not *regular* to give it to me. I could not but think this rather contemptible, as I have seen these pens in fifty shops in London, and that they are therefore not made exclusively for that in question; I therefore take this method of avoiding a second time the *irregularity* of endeavouring to obtain that information which I foolishly thought no person of liberal mind would feel disposed to deny me.

I am, Sir, respectfully yours,
G. H.

BRICKS.

SIR,—Several answers have been solicited by your Correspondent Rusticus, in No. 75, concerning Bricks. Will you allow me to add to his inquiry a request for information on the nature of Pipe Clay. Is it a fit substance to make bricks of, where it can be obtained in great quantity?

Is there any essential difference between the clay used for brick, and that for pottery or crockery-ware, or is it only a finer sort of which the latter vessels are made?

Perhaps you will best reply to both of us, by pointing out some treatise on brickmaking, if such there be.*

In the absence of scientific intelligence, I can inform Rusticus, that the red colour in tiles and bricks is not always caused by ferruginous matter; but those burning white will, where they touch others in the kiln, become red, and this red is only on the surface, as may be seen by breaking them: those bricks which are red all through are probably of ferruginous clays. Frost, before bricks are dried, is their greatest enemy; for even on burning them afterwards, they become absolutely rotten, and will not stand the least blow.

The Dutch very generally do over their brick buildings with a mortar or plaster mixed with oil and colour; blue, red, or light pink, and grey, are the most common colours: when dry, such walls have a kind of gloss like varnish, and, of course, resist all wet.

In the United States of North America, brick houses are painted afterwards; they are not otherwise deemed finished. Red lead and Spanish brown are used.

Many of the brick houses in England admit the wet through the walls, from the light, bad, porous quality of the brick; especially when a shower of rain, mixed with snow, comes with a strong wind. I have known an eighteen-inch wall so penetrated quite through. The Dutch method of using coloured mortar, as above described, is certainly a better mode of proceeding than the English custom of using bad absorbing bricks,

* As good an article on Brickmaking as we remember to have met, is to be found in the Encyclopædia Metropolitana, whence it was extracted into our own pages (vol. II. p. 76—79). It is from the pen of Mr. Elmes, architect.

and not admitting them to be made weather-proof, for fear of losing their colour. The coating or covering can be of any colour desired.

Pug-mills are so numerous about London, I advise Rusticus to examine them for himself, which will answer his purpose better than any description I could give. Clay alone will certainly make bricks, but not all kinds of clay, though nearly all.

I remain, Sir,
Your most obedient servant,
TILLBROOK.

LOADING RIFLES.

SIR,—It is the present practice among gun-makers to provide their Rifle Gun-cases with a small wooden mallet, which is used in charging the rifle, to force the ball into the mouth of the piece, by several blows, as the ball, with the linen or leather (which is placed under it), is frequently too large to be conveyed into the barrel by any other method. Now, as it must necessarily be acknowledged by any person who has the least knowledge of gunnery, that the direction of the ball is materially assisted by the perfectness of its sphericity, and as the upper part is flattened by the above custom of using the mallet, it appears that this method of forcing the ball into the barrel is, to say the least of it, ill-judged. I was led to these remarks, about a week ago, by happening to see some gentlemen trying rifles at Chalk Farm; one of them, who certainly was a good shot, went several times rather wide of the mark, although assisted with a rest. Those present imagined there was some defect in the position of the sights. I observed, however, *in my own mind* (as suggestions are not always taken as well as intended), that, in charging, the ball was very much flattened by the use of the mallet, and I judged that the gentleman would never make a certain shot while this was the case. At last I observed the ball go into the barrel more easily, and without being flattened at all; now, thought I to myself, if he covers his object, he has a fair opportunity—he fired—the ball, as I expected, shivered the card, which fully confirmed my opinion of the impropriety of using the mallet in the above manner. Now, as it is necessary to have some effective method to force the ball into the barrel (as the tight fitting of it is a *sine quâ non* to a good marksman), I should think that a short punch or ramrod, with a concavity at one end corresponding to the size of the ball, covered over with leather (such as are seen on some rifle ramrods), might be applied to the ball, while the other extremity might be struck with the mallet. This method (if the punch be kept tight against the ball) will never injure the form of the ball. When it has entered a few inches into the barrel, the regular ramrod, with a similar concavity, must be used, but it never should be lifted up and down to strike the ball, which should be sent home by pressure, or it will never carry fair.

I am, Sir,
(for the first time)
Your humble servant,
T. M. M——N.

EXTINGUISHING FIRE ON BOARD SHIPS.

SIR,—From the many accidents of ships taking fire at sea, and these commencing in parts of the vessels not easily got at, it appears to me that a reservoir, on deck, with pipes either of leather or lead, communicating and opening into various store rooms, such as the spirit-room, powder-room, &c. would be the means of procuring an instantaneous application of water. The mouths of the different pipes should be marked, so that only that which led to the part on fire should be opened. In my opinion this arrangement would give passengers and all on board a very great assurance of safety; and I have no doubt the expense of it would be compensated by the allowance the Insurance Offices would make in favour of such ships.

I am, Sir,
Your obedient servant,
J—— B——.

NEW RULE FOR MEASURING ROUND TIMBER.

SIR,—The following paper is the production of a person in this town, whose acquirements in mathematics, mechanics, and general knowledge, are entirely the result of his own abilities and application, without having derived advantages of any description from education—in fact, he was brought up as a bricklayer, and even follows that calling at the present moment. He was recommended by me to take in your admirable Work, with which, on all occasions, he expresses himself extremely pleased. Should you deem it worthy of appearing in your pages, he will feel much flattered; and, on future occasions, you may find him a valuable contributor to your work, and a striking exemplification of the power of natural talent.

I am, Sir, your very obedient servant,

E. S. STRATTON READER.

St. Bartholomew's, near Sandwich, Kent.

SIR,—I take the liberty of requesting the favour of your inserting the following brief remarks, experiments, and subsequent calculations, relative to Round Timber Measure. Your Correspondent T. H.'s views on this subject agree with mine; but as T. H. has not illustrated the observations he has offered on this head altogether satisfactorily, in my opinion, I will, with due submission to him and the rest of your mathematical Correspondents, submit the following explicatory remarks:—

My principal intention is, to demonstrate an approximated method of measuring round timber; at least, such as may, in some degree, approach nearer to the truth than the rules hitherto generally made use of by calculators. But, before I proceed to give the experiments and calculations, I beg permission to lay down a general hypothesis, to be regarded as a standard in an investigation of a proposition which has for its object a new theory, which shall be every way subservient to the mechanical practitioner.

Now, as irregular pieces of timber (trees) consist of various shapes, such as obtuse ellipses, distorted circles, and, in many instances, a sort of triangular or trapezi-angular formed sections (were the same sawn asunder in several places), to find the true mean area of the many sections or quantities contained within the circumscribing compass of the respective girts, when taken by actual measurement, is what I apprehend to be the chief difficulty. The first particular to be observed consists in the method of girting the tree, or piece, whose contents are required; and the second is the mode or rule of calculation. In regard to the former, the method of girting may be comprised in a general rule, to be observed with some restrictions, hereafter to be noticed. The method or manner of girthing I would recommend is, in the first place, to divide the length of the tree into several equidistant parts or portions, say five or six; then, with a small cord or line, as usually made use of, girt the tree where the points of division may happen to fall between the two ends, taking in at the same time the girt of the ends, or nearly so, as may be thought proper (vide remarks subjoined). This being done, the mode of arrangement and rule of calculation, in the latter particular, is as follows:—

Let G be the sum of all the girts, and n the number so taken: then will $\frac{G}{n}$ be $= m$, the mean or common girt; and hence the rule of computation is $\overline{\frac{m}{5}}\Big|^2 \times 2 - \overline{m \times .025} = A$, the approximated area of the compensating mean girt, which area is to be multiplied by L, the given length, as $L \times A = Q$, the cubic quantity required.—(See Remarks.)

Illustration of these Rules, by actual Experiments, to ascertain the Cubic Quantity of Round Timber.

Having provided three models of wood, in the shape of round timber, retaining the several inequalities incident thereto, and having likewise pro-

cured a tube sufficiently large to admit each piece separately, I filled the tube, having one end stopped, with water, and then reserved the quantity in a cylindrical vessel, to be properly guaged. The tube being now empty, I put in one of the models, marked No. 1, and then poured in the water I had reserved till the tube again was filled; the remaining water in the vessel being equal to the cubic quantity of the modelized piece of wood. Then, with a guage or scale of equal parts, I guaged and calculated the respective quantity found in No. 1. I proceeded in this manner with the other two models, calculating the respective quantities in decimal proportion according to the divided scale of equal parts, setting down the result corresponding to each number or model. The next thing I had to attend to was to divide the models into equal portions, in order to girt each as per rule (obtained by trial); then, with a very fine thread, I began with No. 1, at one end, to girt the model, measuring the length of the girt by applying it to the same scale of equal parts as I made use of to guage the vessel. The length of each girt I set down, and collected their sum as per rule, which are as follows:—

Results and Calculations obtained by Experiments.

To No. 1.

	Girts.	
No. 1	= 38.6	Length = 66.22.
No. 2	= 38.5	ditto
No. 3	= 37.7	ditto
No. 4	= 38.0	ditto
No. 5	= 37.5	ditto
No. 6	= 37.7	ditto
No. 7	= 37.3	ditto

$\div 7 = n$) 265.3 sum of girts = G.

37.9 = *m*, or mean girt.

To No. 2.

	Girts.	
No. 1	= 38.76	Length = 72.5.
No. 2	= 36.5	ditto
No. 3	= 37.6	ditto
No. 4	= 36.37	ditto
No. 5	= 34.42	ditto
No. 6	= 34.00	ditto
No. 7	= 35.00	ditto

$\div 7 = n$) 252.65 sum of girts = G.

36.092857 = *m*, mean girt.

To No. 3.

	Girts.	
No. 1	= 28.5	Length = 59.8.
No. 2	= 28.3	ditto
No. 3	= 28.6	ditto
No. 4	= 28.0	ditto
No. 5	= 28.7	ditto
No. 6	= 27.0	ditto
No. 7	= 27.5	ditto

$\div 7 = n$) 196.6 sum of girts = G.

28.0857 = *m*, mean girt.

The Division of Quantities for Calculation.

	Quarter mean girt.	1-5th of m. girt.
To No. 1	= 9.475	= 7.58
No. 2	= 9.02321425	= 7.218571
No. 3	= 7.021425	= 5.61714

The reserved quantities, as calculated from experiments of immersion in the tube—dimensions of vessel omitted.

		Cubic quantities obtained.
To No. 1, (accurate guaging)		= 7592.980164
No. 2	ditto	= 7442.026284
No. 3	ditto	= 3773.847

Quantities per Rule and Girts, as proposed by me.

To No. 1 . . . . . . $7.58^2 \times 2 - \overline{37.9 \times .025}$ Multiplied by . . . . . . 66.22 } = 7546.9146

To No. 2 . . $7.2185712^2 \times 2 - \overline{36.092857 \times .025}$ Multiplied by . . . . . 72.5 } = 7438.5568

To No. 3 . . $5.61714^2 \times 2 - \overline{28.0857 \times .025}$ Multiplied by . . . . . . 59.8 } = 3731.6708

Quantities calculated by the common Rule, hitherto generally practised.

To No. 1 . . . . . $9.475^2 \times 66.22 = 5945$
To No. 2 . . . . . $9.02322^2 \times 72.5 = 5911$
To No. 3 . . . . . $7.02145^2 \times 59.8 = 2948$
} Decimals omitted.

REMARKS.

These results show that the customary rule makes the quantity a great deal too little, while the rule I have adopted comes very near the truth, as may be seen by comparing the cylindrical quantities to those ascertained by calculation.

The following is an example, by duodecimals, applicable to the new rule :—

Take a piece of round timber, whose length is 42 feet 6 inches, and girts as follows :—

	Girts.
No. 1	= 78 inches.
No. 2	= 69
No. 3	= 60
No. 4	= 66
No. 5	= 53
No. 6	= 58
No. 7	= 40
No. 8	= 43

$+ 8$) 467 sum.

Mean girt. . 58.375.

Then, per rule, $\frac{58.375}{5} = 11.675$; which, being duodecimally expressed, is = 0 ft. 11 in. 8 p. 1 s. 3 t., &c. Say, then, per rule—

		Ft.	In.	P.			
		0	11	9			
				× 11	9		
		10	9	3			
			5	10	6	half of top line.	
			2	11	3	quarter of ditto.	
		11	6	0	9	$= \frac{in^2}{5}$	
					× 2		
Quantity of area for cubic measure. . =	1	11	0	1	6	$= \frac{in^2}{5} \times 2$	
Correcting factor* . . . . =			—1	6	0		
Length . . . . =	1	10	10	7	6		
					× 10 × 4 + 2 + 6 inches.		
	19	0	10	3	0		
					× 4		
	76	3	5	0	0		
	3	10	0	3	0	twice.	
	0	11	5	3	9	for six inches.	
	81	0	10	6	9	cubic quantity.	

If the piece had been calculated by the customary rule, the quantity would be several feet less; which, to avoid figures, I abbreviate thus : $\frac{58.375}{4} = 14.59$. Say, 14.6 in. = 1 ft. 2 in. 7 p.; then, $\overline{1, 2, 7}|^2$ = 1 ft. 5 in. 8 p. 8 s. 1 t., which, being multiplied by the given length, gives quantity = 62, 9, 2, 7, 6, &c., which, being deducted from the former quantity, leaves a difference of 18 cubic feet, which is of some importance to those who carry timber by weight.

* The correcting factor is 1 in 40, which, for 58, we may take 1½; which, when the duodecimals are squared, every unit, or 1, will be parts, making 1½ = 1–6, as above.

If one end of the tree be suddenly much larger than the rest, girt the mean or half the distance between where such suddenness of bulk commences. If the tree is regular throughout, from end to end, and the girt small, the rule, $\overline{\frac{m}{5}}\Big|^2 \times 2 \times L$, will not greatly, if at all, exceed the truth. But as no trees are truly circular, the correcting factor, $m \times .025$, should be used. Also, if a tree be of a triangular form, from end to end, the correcting factor should be $m \times .25$; but, in all other cases, the preceding rule appears to me admissible, unless that any discovery in measuring leads the calculator to apprehend that the mean girt is too little, and, consequently, the mean area too little, which would be difficult to determine, as a variety of circumferences may occur in which there may be but little variation in the area of any respective section.

Thus far I have attempted to establish a new rule for computing the cubic quantity contained in irregular pieces of round, unhewn timber. The method of girting gives the equalizing area, and the rule of computation, in a few figures, the cubic quantity.

I now leave the subject to the correcting remarks which any of your mathematical Correspondents may think proper to make, and shall reserve other observations on this head for a future paper, trusting that what is here advanced may be found not undeserving a place in your esteemed work.

I am, Sir,

Your most obedient servant,

H—— F——.

Fisher's-street, Sandwich.

IMPROVED PROCESS OF HARDENING STEEL.

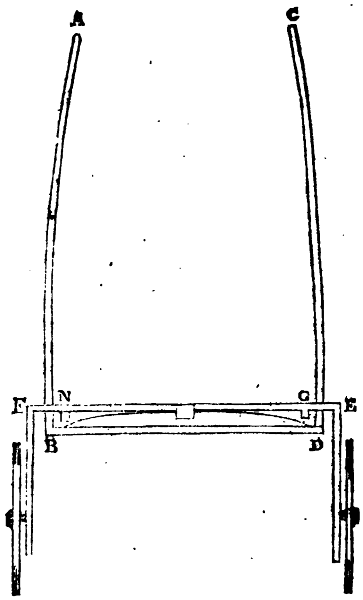
Sir,—It gives me some pleasure to see, in Number 90, page 90, of your valuable little work, the Mechanics' Magazine, an article copied from Nicholson's Operative Mechanic, just published on this head. By this I trust you will stimulate some of our manufacturers to set about improvement in good earnest before it is too late. For my own part, I have for some time past given up all hopes of ever having a good knife again, unless by chance. I wear out a great many pencils, and my wife (who has about thirty young ladies to teach writing) a great many pens, from the want of one. "Sharp, sharp—do sharp my knife!" is the order of the day. I try to sharp, but no edge is to be obtained. I give one, two, three, and four shillings a-piece for knives, and there may be one out of half a dozen that may be worth sixpence, and will *cut a little;* but that is all. Pray put another spur to this edge-tool business, and you will confer a favour, I am sure, on hundreds, as well as myself.

I am, Sir, &c.

A Constant Reader.

6, East-place, Lambeth, May 16.

PROPOSED IMPROVEMENT ON WHEEL-CARRIAGES.



Sir,—I shall be glad to know from some of the Correspondents of your valuable Magazine, qualified to give an opinion on the subject, whether any ease would be afforded to a horse by the adoption of a plan, of which I have endeavoured to convey an idea by means of the above draft.

Description.

A and C are the shafts of a carriage.

BD, a bar connecting them.

EF, a bar connected with the carriage.

Two springs are fastened to EF, and work against BD.

G and N are two stops, fastened to EF, to prevent the springs being over-strained, and against which BD would rest when the springs were strained to a certain point.

The shafts A and C would pass through two holes made to receive them in EF, and would, together with BD, be moveable, so as to operate on the springs.

I much fear I may not have rendered myself intelligible, as I am not at home at mechanical terms, and that my ignorance of mechanics may have induced me uselessly to trouble you; but, from the consideration I have been enabled to give this plan, it occurs to me, that by its adoption a horse would be much eased at starting, and on meeting with any obstruction in the road.

I am, Sir,
Your obedient servant,
Bath. R. E.

CANAL ECONOMY.

Mr. David Townsend, of Pennsylvania, has invented a method of saving water as the boats pass through the locks of canals, by which not a gill, it is said, will be lost. By the application of a machine, on all summit levels, no more surplus water will be required than will be lost by filtration and evaporation: there is no filling of locks by side or sluice gates, and the strength of a single man, with a simple mechanical power, will do all the work, and pass a boat in *half* the time required on the present plan.

SHARPING RAZORS.

Sir,—I congratulate mechanics on the appearance of your work: like the morning sun, your pages will disperse the mists and clouds which hang on the mechanic's horizon. Has he any doubt of his *little* discovery or invention being *new*, he can now make inquiry till he be satisfied, and then the *way* is open even to *him*, which was not so when I was young. Your second volume contains a method, (from the Glasgow Magazine) of setting a fine edge on a razor: I have used the same for more than thirty years, and *then* mentioned it to James Bolton, of Halifax, *Naturalist*. He said, "the strops sold in the shops were covered with black lead:" so it rested—but mine set a finer edge, and I use it still. The discovery was simply this: A Bible, in rough calf, lay (except when used) on a pewter dish turned bottom up; the book being shoved thereon got a coating of metal; I was in the habit of strapping my razor on it, and found it shave *better* than when done on any thing else. There was not then those facilities for such *little* (and, of course, useful) things being made public, as are now furnished by the Mechanics' Magazine and other works of a similar description.

I am, Sir,
Your obedient servant,
A Clumsy Mechanic.
Halifax, 29th April, 1825.

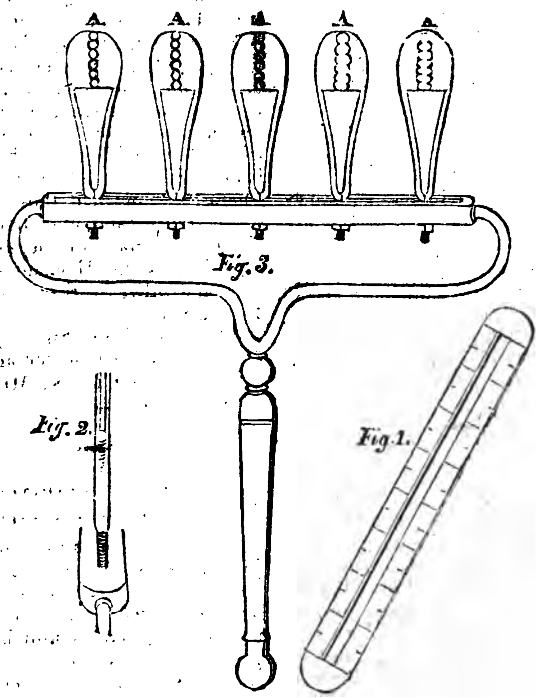
THE "STEAM WASHING-BOX."

INFORMATION WANTED.

Sir,—Will you allow me to ask Mr. Haspy Smolet, through the medium of your pages, whether the description of the method of Washing by Steam, given by him in vol. iv. p. 21, is the result of actual trial successfully made, or otherwise? I ask this question, in the hope that such of your readers as may be disposed to make the trial, will defer doing so until they receive his answer; for, some years ago, in consequence of a similar account of washing by steam, in Rees's Cyclopædia, under the head Laundry, I made the attempt, very much in the way Mr. S. describes; and although I consider I gave it a full trial, I entirely failed. I tried the steam at 212° and higher temperature, and both soaked and soaped the linen previously, but could not produce the effect of cleaning it, though the linen was exposed to the steam ten or twelve hours, and consequently I concluded that some additional application of pressure or friction was necessary.

I am, Sir,
Your obedient servant,
J. S. M.
7th May, 1825.

NEW METAL-JOINTING INSTRUMENT.



SIR,—I have the pleasure of transmitting to you a representation and description of a tool of my own contrivance, and if you think it worthy a place in your highly interesting Journal, in order that mechanics in the Metal-Jointing way may become acquainted with it, it is at your service.

By workmen, jointing is considered a nice piece of work, and difficult to do well; it requires a deal of time, and gives much trouble. Knowing this, and having many things to do in this way, I put both head and hands to work, in search of something that would diminish that time and trouble, and enable my fellow-tradesmen to make their joints with greater ease and expedition; and you will shortly see my exertions have not proved fruitless.

For the information of such of your readers as are unacquainted with this branch of art, it will be necessary for me to describe the present modes of jointing, which are as follows:—

After the wire is drawn, we take a pair of dividers and set them about the size required; we then make our joint-wire with them, and afterwards part them with a saw, and place each piece in a pair of sliding-tongs, and file the pieces down to them. By this plan we can only file one piece, and one end at a time; and, therefore, for those who have a number of joints to make, the process is a very tedious one. Another plan is, to use, instead of a pair of sliding-tongs, a block of iron, with a hole through the centre; the wire is pressed into it, and filed flat to it on both sides. Now, by this plan, you need as many sized blocks as you have sized joints; the block that serves one snuff-box, armlet, or bracelet,

will not serve for a larger or smaller one, so that this plan is on a par with the other. There may be better plans of jointing than these, but I never heard of them. By the tool which I have invented, the length of the joint, or the thickness, will be no obstacle—the tool will accommodate any size; and by two cuts of the saw, there will be a dozen pieces or more, according to the size of the tool, already smooth and square at each end. For filing there is no occasion, as the saw does all that is required, and the joint is completed in less time, with less trouble and equal neatness. This tool may be used for cutting of lengths of wire, of all shapes and sizes, with accuracy and dispatch.

I am, Sir, yours, &c.

A GOLDSMITH'S APPRENTICE.

Description.

Fig. 1 represents the plate which the springs, AAAAA, slide into, divided the same as a rule, for the convenience of shifting the springs exactly as wanted.

Fig. 2 shows the width of the springs edgeways, and likewise the split down which the saw descends.

Fig. 3 gives a view of the springs, and also of the plate in which they are supposed to be screwed, showing the screw and nut underneath. Three of these springs are represented shut, and the other two open. The view given of the springs is a side one; that side of the springs now fronting us will be turned to the end of the plate, and the edge of the springs, as represented at figure 2, will be turned towards us. By unscrewing the nuts, springs may be taken out, or more put in, as wanted. In setting the tool for any particular size, an allowance must be made for what the saw reduces. There will be no difficulty in pushing the pieces out after they are cut; take some more pieces of wire and press in, and the other pieces will tumble out.

Directions to the Maker.

As the springs have nothing to press against, it will be necessary to make them strong; the chops of the springs must be fluted for the round wire, or else the wire will shift, and the split at the top of the spring must be made correctly straight, otherwise the tool will not answer. The split must be made so that the saw shall not move about in it, only forward and backward—the thickness of a piercing saw will be sufficient. The flutes must also be level with each other, otherwise the wire will not find its way through. The plate may be made of a rough file, leaving the teeth underneath; and the nuts ought to be made of the same—if not, the springs will be liable to shift. Perhaps it would make a better finish to the tool, if a groove were cut underneath the plate, of the size just sufficient for the nuts to move in, and just the depth of them, so that when the springs are screwed, there shall be no appearance of either nut or screw.

PERPETUAL MOTION, AGAIN.

Let those laugh now, who never laugh'd before;
Let those who ever laugh'd, now laugh the more.

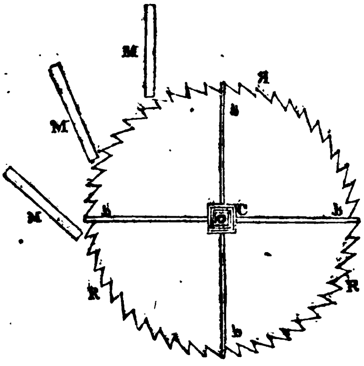
SIR,—I am aware, and therefore anticipate from you at least a laugh, upon receiving a communication on this subject; but if your risible faculties can be composed, I would then invite a few serious moments.

You will agree with me, that the universe is a display of perpetual motion, and that such a thing does, beyond all doubt, exist. The cooperation and nice combination of what or how many various causes (each perhaps governed by different laws, and opposite in their effects) which produce this perpetual motion, it might be presumptuous to endeavour to ascertain; suffice it to know, that all concur in a most wonderful manner to exhibit what man is striving to discover, and hitherto in vain.

I coincide in opinion with those who consider there are insurmountable difficulties to the discovery of perpetual motion, by any machinery wholly subservient to the laws of gravity and the mechanical powers; and as the perpetual motion of the universe is not effected under the laws of gravity only, there appears but little probability of man's discovering it by such machinery.

By consulting Nature's laws generally, success is more likely to follow; and, indeed, an invisible (but well known) agency is available for the purpose. I have, therefore, re-

sorted to an auxiliary, that operates wholly independent of, and in opposition to gravity, to effect perpetual motion; with what success you will see.



Description.

The above drawing represents a wheel of one foot in diameter, revolving on its centre, C. Its circumference, RRR, is a thin steel hoop, or rim, three-quarters of an inch broad, formed in the indented manner delineated, and connected to the centre by two bars, *bbbb*. (The thin edge of the rim presents itself to view.)

MMM are three magnets fixed; totally unconnected with the wheel; their poles are placed as close as possible to its rim, but not to touch it, to impede its going round. These three magnets are so disposed as alternately to exert their full attractive powers, at right angles, on the flat indented surfaces of the steel rim of the wheel; and as it moves round, the attraction of one magnet does not cease its operation until another magnet exerts its full power.

The weight of the wheel on the side next the magnets being thus continually lifted, or rendered lighter, by the attraction of the magnets, causes the weight of the opposite side of the wheel to preponderate on its centre, and the wheel to revolve, and to continue a perpetual rotatory motion—at least, as long as the magnets retain their attracting power.

By inserting the foregoing in your truly useful publication, you will oblige,

Sir, your humble servant,

and constant reader,

NRUBKCALB CAASI.

Ware, Herts.

IMPORTANCE OF THE BAROMETER, AS INDICATING THE APPROACH OF HURRICANES.

In an article by Colonel Wright, inserted in our 30th Number, on the Rise and Fall of the Barometer within the Tropics, the writer gave many strong proofs of the advantageous use which navigators might make of the indications of this instrument, especially in those cases of violent hurricane that occur so frequently in the Indian Seas. The following corroborative remarks on the subject, we extract from an interesting letter to the Editor of the *South African Chronicle*:—

"Every one at all acquainted with the mechanism of a barometer, is aware that its construction originated in a discovery, that the mean density of the atmosphere is capable of supporting a column of mercury equal to about thirty inches in length; it follows, therefore, that every deviation from that height is the result of some change or other in the actual density or gravity of the atmosphere which supports it, the trifling effect excepted which is produced by the attractive and cohesive qualities of the tube in which it is confined; but, although it is clear that no alteration can take place in the quicksilver, which is not occasioned by a proportional change in the weight of the atmosphere, these changes depend upon such a variety of causes; and are frequently so minute as not to be perceptible, or accompanied by any visible alteration of the weather, which is the reason why small deviations in the barometer do not always indicate any change whatever in the latter. It is a well-established fact, that the barometer undergoes little or no variation throughout the region of the tropics, except when under the influence of an approaching hurricane, when it is equally notorious that it invariably falls rapidly and considerably, as it inevitably must do, if we consider the principle upon which the quicksilver is supported in the tube, and connect it with the probable cause of these storms, which are as much exceeded in violence, as the situations in which they are generated are at most other periods in mildness, by the more boisterous climates of Europe.

"Of the danger attending them, I have acquired some degree of knowledge from dear-bought experience, and of their approach we may at all times be warned by an infallible monitor, although I fear it is too often fatally slighted, through ignorance, perverseness, or prejudice; because that part of the ocean to which these remarks are confined is

frequently sailed over without having to encounter a hurricane; and because, throughout such navigation, the barometer *may* remain almost stationary, it is too apt to be thought a useless appendage to a ship in those seas; but, so far is this from being a just conclusion, that, in my opinion, the circumstance of its not being affected by any other weather than such as is attended with imminent danger, is the strongest argument that can be adduced for its being particularly valuable in those regions. In high latitudes the experienced eye and judgment of the sailor prove a pretty correct substitute for a barometer; but the tropical hurricane, like the wolf in the fable, always comes on when least expected, so far as appearances are concerned, and therefore the barometer is the only guide to be safely confided in. My conclusion then is, after many years experience of the navigation of those seas, as well as from theory, that, whenever the barometer is observed to fall suddenly and considerably any where within the tropics, it may be considered indubitable, that an uncommon degree of rarefaction of that part of the atmosphere is in progress, and that it will inevitably be followed by a violent reaction. Not a moment, therefore, is to be lost in bringing the ship to the wind, and preparing her for a storm; from that moment the ship has passed the circumference of a circle, the centre of which is the centre of danger, inasmuch as it is the centre of the atmospheric expansion. Among other instances, in corroboration of this argument, which have come within my own knowledge, I shall relate the particulars of two.

* * * * * * *

"After taking under review the circumstances as connected with the two particular instances I have quoted, together with the result of some consideration of the subject, after many years experience, I think I may fairly conclude, that the barometer will infallibly indicate the approach of a hurricane within the tropics, and that where the storm commences, there will it first subside, and there will it be most moderate: and if this be the truth, one would almost think it were an instrument placed by Providence in the hands of sailors to warn them of their danger; for if they are to proceed in their course, in defiance of such warning, the barometer might as well be on shore. The sailor is an amphibious animal, and there being something peculiar in the disposition of animals which partake of a twofold nature, I recommend, in conclusion, that those gentlemen and ladies from the East, who have recourse to our salubrious climate for the purpose of repairing their shattered constitutions, should never, but when it cannot be avoided, engage a passage in a ship that is not possessed of one, and that they should keep guard over its silent salutary warnings themselves."

NAVAL ARCHITECTURE.

Sir,—If the following remarks on the papers in page 427, volume III., and pages 30 and 50 of volume IV. of your very useful and interesting Magazine, should appear worthy of your notice, you will, by inserting them, afford pleasure to one who wishes to think correctly and liberally, and who would endeavour to enable others to think so too.

The point in dispute between the writers above referred to, seems to be, whether or not the advantages of liberal and scientific instruction may not conduce to the improvement of the intricate, and, at present, very imperfectly understood art of constructing ships?

If the question be determined in the affirmative, as it certainly must be, it would seem desirable that individuals of scientific attainments should, by some means or other, be induced to devote their time and talents to the advancement of an art of such essential importance to the welfare of the nation, since both the acquisition and the protection of its wealth greatly depend upon it.

With this view, it is presumed, the Government determined to establish the Academy of Naval Architecture at Portsmouth; and it was, without doubt, the most eligible way of providing for the supply of that knowledge, in which we, the greatest maritime nation in the world, are shamefully deficient, compared with our neighbours, the French, and perhaps the Americans. The method of selecting the students for the Academy was also the most wise and liberal that could have been adopted. It was publicly advertised, that an examination for the election of students would take place; and thus an opportunity was afforded for any one who chose to offer himself as a candidate. The working apprentices of the dockyards were, and still are, permitted to enter under rather more advantageous circumstances than other individuals. The examinations, there is every reason to believe, have hitherto been conducted with the most scrupulous impartiality; the preference having been given to those who, by the superiority of their talents and attainments, merited it.

An institution established on such liberal principles is an honour to the country and to the Government that maintain it; and it ill becomes such persons as Anti-Calculus and Omega to endeavour to bring such an institution, together with the founders of it, into

disrespect. The existence of such an establishment was loudly called for by the general want of every sort of knowledge, except that which the mere mechanic usually possesses, and which alone prevailed in our dockyards. The conducting the important duties of many situations in those departments with ability, requires persons whose habits of thinking and acting are of a more general and philosophic description, than those of men who have spent the prime of their years in the exercise of the adze and the axe. The latter are scarcely ever competent to transact official business with the clerks of public offices; and though it has always been considered desirable that they should be qualified to perform every duty, by correspondence or otherwise, with equal ability and dispatch, it has almost universally been acknowledged that the practical man was inferior to the man of the desk.

What would be the condition of our army and navy, if all the officers had been raised from the lowest classes of men—the seamen and marines, the rank and file? Where would be our able commanders and engineers? Who could have conducted the various scientific operations, which have been the principal means of those brilliant achievements which have added so much to our national glory? And ought we, then, to suffer our dockyards alone, in which a general knowledge of mathematical science is as useful and requisite, at least, as in any other department of the national service, to be entrusted to the management of men without education and scientific information?

The opinion of our Government is doubtless against it; and the voice of the well-informed friends of our country, in which every art and species of knowledge are making rapid progress towards perfection, must be unanimous for the encouragement of the improved system which, it is hoped, will be introduced into our naval architectural department, by means of the Academy instituted at Portsmouth.

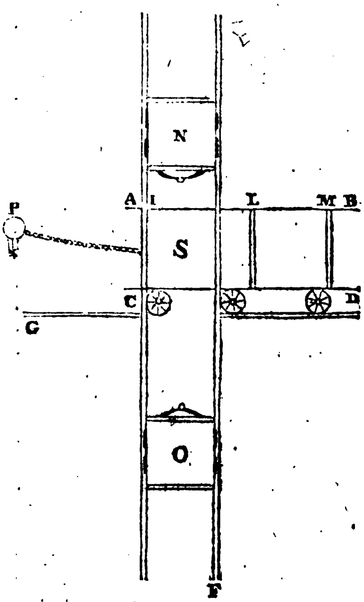
I hope that Anti-Calculus and Omega will excuse my having taken a view of the subject different from what they have. The statements of the former Gentleman, though they may appear plausible, will be perceived, by persons who fully understand the subject, to be weak and refragable. Omega seems disposed to deprecate innovations; and, either through a want of enlarged views of things, or that blindness which is necessarily conjoined with self-interested considerations, not to know that it is one of the wise maxims of modern times, that the interests of the few, although the circumstances may be inconvenient, must sometimes be sacrificed for the benefit of the whole.

"A Shipwright" has raised a feeble hand in the defence of an institution, from which it would be reasonable not to expect much, if the members of it did not feel an emulous pleasure in restricting themselves to a few hours rest for many successive nights.

It was remarked by Dean Paley, in reference to the nurseries of our national religious establishment, that "many seeds must be sown to raise one flower." The observation is of general application; and it is to be supposed, that in every public institution individuals will be found of greatly varied degrees of merit. Upon a just discrimination of real excellence, and a judicious awardment of suitable encouragement, must depend the flourishing condition of all public establishments, and of that denominated the School of Naval Architecture.

I am, Sir,
Your obedient servant,
MECHANICUS.

PLAN FOR SHIFTING CARRIAGES ON RAILWAYS.



SIR,—In all extensive rail or tram roads, where much work is doing in both directions, to prevent the inconvenience of two waggons meeting, a long curvature in the road

must be applied, to give a passage, which must considerably increase the expense of construction. The plan I here propose to be laid down, I think will be deemed worthy of application, as it will be attended with considerably less expense, and may be applied in an elevated place with the same facility as it can be on a horizontal.

Description of the Drawing.

Let S be the appointed station for the waggons to pass each other, and ABCD a long waggon, placed on six wheels, running at right angles with the general railway, EF, on a piece of railway, GH, below; and across the waggon, ABCD, there must be laid two pieces of railway, IK and LM, somewhat longer than the waggons, N or O, and at a convenient distance from each other, to correspond exactly with the general rail; so that, by running the waggon, N, on the rail, IK, and then with a winch, P, placed at one end, drawing the waggon, ABCD, far enough to bring the other piece, LM, into the general line, the other waggon, O, may pass on without interruption; and again, by returning the waggon, ABCD, to its first position, the waggon, N, may pass on, and the waggon, ABCD, be ready to act in the same manner when necessary. The rail, LM, might also be constructed as a revolving table, and serve to continue a road in any other direction, without any connecting branches.

A. B.

KING CHARLES'S PUZZLE.

SIR,—On the question, "Whether a vessel of water would not weigh a pound heavier by having a live fish, which weighed a pound out of water, put into it?" your Correspondent, "T. H.," (page 62, Number 88), modestly states his opinion, "that the vessel will not weigh a pound more." But, before any of your readers render up their judgments to his argument, allow me, *Scotchman-like*, to answer, by *asking*, What does he mean by saying the fish buoys itself—the water does not? Can he mean that the water does not assist it? If so, take away the water, and where will be the fish?

If he mean that the specific gravity of the fish is greater than that of water, he is perhaps right; though this property (in most fish) is very little greater than that of water, as is seen when a dead fish is thrown into the water, from the slowness with which it descends. I conclude this to be his meaning, and ask him, Can the fish raise itself without a purchase? If not, then, granting his position of the question, it seems that, suppose the fish, by reason of its weight, to exert, when stationary, a force upon the water beneath it equal to one pound, must not its efforts to raise itself in the fluid be equal to the same?

If "T. H." will ask himself why any body, when placed in a fluid, floats? he will see that the self-buoyancy of the fish can never hinder the action of its gravitation from being exerted on the fluid; as, when it ascends, it is the upward pressure of the water (either by action or re-action) that makes it do so, and there is no time when the whole weight of the fish does not operate in one direction or other on the fluid; and the pressure of fluids being in all directions, any one may draw the inference.

As to the internal power of buoyancy, almost every fish is furnished with an air vessel, which is commonly called "the swim." But how this can so much assist or accelerate their velocity of motion, I cannot see. A boat floats on water, but its power of floating never accelerates its velocity. In fact, the power of a fish's tail to move it, and its fins to guide it, is much greater than "T. H." has any conception of, or he would never have used the expression with which he concludes his paper. As to his reasoning about the weights, it appears "not to the purpose."

I am, Sir,
Your most obedient servant,
T. M. M—N.

METALLIC CASTS FROM ENGRAVINGS ON COPPER.

A most important discovery has lately been made, which promises to be of considerable utility in the Fine Arts: some very beautiful specimens of metallic plates, of a very peculiar composition, have lately appeared, under the name of 'cast engravings.'

This invention consists in taking moulds from every kind of engravings, with line, mezzotinto, or aquatinta, and pouring on this mould an alloy, in a state of fusion, capable of taking the finest impression. The obvious utility of this invention, as applicable to engravings which meet with a ready sale, and of which great numbers are required, will be incalculable, as it will wholly prevent the expense of retracing, which forms so prominent a charge in all works of an extended sale. No sooner is one cast worn out than another may be immediately procured from the original plate, so that every impression will be a proof. Thus the works of our most celebrated artists may be handed down, *ad infinitum*, for the improvement and delight of future ages, and will afford, at the same time, the greatest satisfaction to every lover of the Fine Arts. —*Nicholson's Operative Mechanic.*

EGYPTIAN ORE.

SIR,—I should feel much obliged to any of your numerous readers and correspondents who would favour me with his candid and unprejudiced opinion upon a metal sold by Mr. M'Phail, and manufactured into various articles of jewellery, under the name of "Egyptian Ore," and if it really answers the description given of it by the inventor. As, firstly, whether it will wear equal to, and retain an appearance of, gold? and, lastly, whether any person who is at all a judge of gold can, upon a superficial inspection, and without submitting it to the usual test, detect it as being only an imitation of that metal.

I am, Sir, yours truly,

QUIBUS.

LEVEL OF THE SEA.

It is proved by many observations, that the level of the sea must have been, at some ancient period, higher than it is at present. This can be easily accounted for, if we consider that water heated must be more expanded than the solid earth. If we suppose, with M. de la Place, that the average depth of the sea is 96,000 feet, and assume the dilatatation of the earth to be equal to that of glass, we find, that at a temperature of 100 centigrade, the sea would be 4000 feet higher than it is at present, and that it would cover most of the secondary mountains. The melted masses shrink during their cooling. If this happens in large masses, cavities, garnished with crystals, must result, and other similar phenomena.

CRAYFORD MECHANICS' INSTITUTION.

SIR,—You will oblige the Members of the Crayford Mechanics' Institution, by giving the following Resolutions a place in your very valuable miscellany.

At a General Meeting of the Members of the Crayford Mechanics' Institution, held this 4th day of May, 1825, the following Resolutions were unanimously agreed to:—

1st. That the thanks of this Institution be presented to Professor Gregory, LL.D., of the Royal Military College, Woolwich, for his Course of Mechanical Lectures to the Members of this Institution.

2nd. That the above Resolution be transmitted to the Editor of the London Mechanics' Magazine, with a request that it may be inserted in that work, that a public testimonial may be given of the high estimation in which the members of this Institution hold the services and talents of Dr. Olinthus Gregory.

3rd. That a copy of these Resolutions be transmitted to Dr. Gregory, signed by the President.

(Signed) WM. WALKER.

Crayford, May 13, 1825.

IMPROVEMENT ON UMBRELLA RINGS.

SIR,—Having often seen others, as well as myself, inconvenienced (at the very worst time too) in sliding up the ring of an umbrella, by the tape to which the ring is fastened winding or coiling round it, I always make the ring for my own with a little swell on one side, and pierce the

same as the eye of a tape-bodkin, and then secure the end of the tape in it. Not only is the inconvenience of which I have spoken thus remedied, but both the tape and umbrella covering are saved from being so much worn by the sliding of the ring up and down. This is a very simple thing, yet I never saw it adopted by any one but myself. Perhaps you will think it deserving of being more generally known.

I am, Sir, yours, &c.

C. M.

ANSWER TO INQUIRY.

NO. 114.

ORDERS OF ARCHITECTURE.

Answer 1st.

SIR,—Although the Composite or Roman Order partakes of the Ionic and Corinthian, and is certainly not so elegant as the latter, yet it has been thought by many to have been used indiscriminately with the Corinthian, in order upon order. This opinion carries some force with it, since the *cornice is always Corinthian.* There are much greater discrepancies than the above to be found in the works of the ancients (even supposing the Composite to be of a more massive nature than the Corinthian). In the Coliseum the same order is repeated; and there are some instances where the intermediate order is altogether omitted, "and the Ionic placed upon the Tuscan, or the Corinthian upon the Doric." How far this may agree with good taste, I will not venture to say, leaving it to every person to form his own opinion. The Composite is generally composed from the frontispiece of Nero (Corinthian), and the Temple of Concord (Ionic). Vitruvius, in the first chapter of his fifth book, says, that "the columns in the second story should be less than those in the first by a quarter; for the inferior part being more loaded, ought to be the strongest."

I am, Sir, yours, &c.

KAPPA.

Answer 2nd.

SIR,—In answer to an inquiry made in your 88th Number, under the title of "Orders of Architecture," I beg leave to state, that the reason why the Composite Order is generally placed over the Corinthian, is, that the *composite order* is much more light and slender in its proportions (as in the best examples, the arch of Titus, at Rome, and others), and also more full of embellishments.

Its composition, from which it derives one of its names, is in the capital only; the superior, or upper part, having the two large volutes of the Ionic, and the lower the leaves of the Corinthian.

A STUDENT IN ARCHITECTURE,
of Six Months' date.

CORRESPONDENCE.

Were we to insert P. F.'s Reply to the Rev. Mr. Grinfield's attack on Mr. Brougham's Pamphlet, it would only serve to give importance to what few have heard of, and nobody cares for. It is impossible that an apostle of ignorance can now make a single proselyte.

J. T. M. need not restrain himself in his communications. We shall be always glad to hear from him.

W. H.'s papers are under consideration.

N. and T. R., on the Balance Question, are too late. We consider that enough has been said upon it. Some of our Correspondents say "*more* than enough;" and were our work intended to communicate new facts and ideas to learned persons alone, we, too, should say so; but our object is, not only to make what is already well known still better known, but to encourage a class of men to write on scientific subjects who never wrote before, and much, therefore, may be tolerated in our pages, which, under a different state of circumstances, might justly be considered superfluous.

Communications received from—Captain Manby—T. C.—W. L.—A Student of the Mechanics' Class—M. P.—W.—C—r.—An Inquisitive Apprentice—A Provincialist—A Practical Shipwright—Frumentarius—John Street—C. W.—Z.—Cranium—T. N.—Ignoramus—F. S.—Rusticus—A Goldsmith's Apprentice—W. Lake—R. B. M.—Quietus St. John.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.
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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 92.] SATURDAY, MAY 28, 1825. [Price 3d.

"In matters of Natural Philosophy we must not pay an absolute submission to even the greatest authority; much less ought we to be slaves to our own prejudices, but to embrace the truth wherever we find it, and not affect to be Newtonians at Paris, or Cartesians at London."—*L'Abbé Nollet.*

PLAN FOR THE PRESERVATION OF SHIPWRECKED SEAMEN,

BY

CAPTAIN G. W. MANBY.

We were favoured, last week, by Captain Manby, with a very useful Code of Instructions for the Preservation of Lives from Shipwreck, drawn up by him, and sanctioned by the approbation of the Norfolk Association; and conceiving that the cause of humanity ought to supersede all other claims on our attention, we hasten to give it insertion. We are sure none of our Correspondents will complain of a precedence which may, possibly, be the means of saving the life of a fellow-creature. The Mechanics' Magazine is, to our own knowledge, a general favourite both in cabin and steerage, and, by the insertion of these instructions in our pages, they have a chance of being more speedily and extensively disseminated than they could be through any other channel.

INSTRUCTIONS.

After the means of communication have been effected between a stranded vessel and the shore, by a rope attached to a shot projected from a

mortar, it is often found a matter of great difficulty to make the persons on board know how they are to act, and many lives have been lost through this cause alone. In order to remedy this evil, and to render this system of relief mutually and immediately understood, the following instructions are submitted:—

DIRECTIONS TO PERSONS ON BOARD VESSELS STRANDED ON A LEE-SHORE.

It is your duty, as well, no doubt, as your inclination, to use every honourable and manly endeavour to save the vessel and cargo committed to your care, and to satisfy yourself that these have failed, before it is a justifiable resource to run the ship on shore, for the preservation of your own lives. On the determination being made to run for the beach, every exertion should be made to keep your vessel off the shore till high water, and then, if canvas is or can be set, steer the vessel stem on, with as much force as possible, making signals of distress to attract the notice of the people on shore, who will collect at the point most favourable for the purpose, and prepare to assist you—endeavour to run for the spot where they are collected. *Shipmasters*, on these occasions, must *enforce* their authority more than ever, and *seamen* must be more than usually *obedient*, as the safety of all on board will frequently depend on this.

Whether a vessel is thus run on shore, or is stranded, without any choice of time or place, the following directions will equally apply, and must be *minutely observed* and *practised*:—

Collect, in some safe part of the vessel, ready to apply as occasion may require, all your small lines and ropes, buoys, pieces of cork, or small kegs (such as seamen keep spirits in), snatch, tail, and other blocks, with a warp or hawser clear, axes, knives, &c.—all these may be of great use.

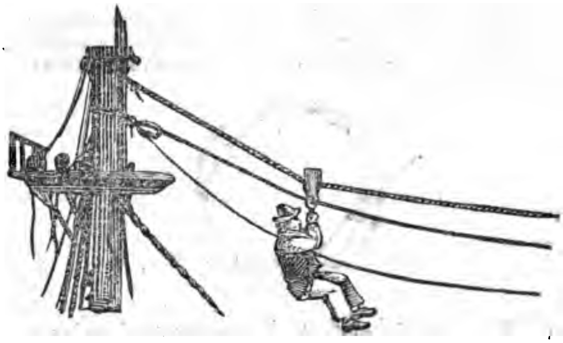
Attend to the people on shore, and observe if they have a boat, or are getting one to the spot, as their first object would be to launch it to you, and to throw a line on board you, to haul her off with; in that case they will make signal No. 1. The signals, illustrated by representations and their distinct meanings, will be hereafter described. On receiving the line, you will secure the end to such part of the vessel as may best draw the boat into a safe lee. If the people on shore, after you have received the line, make signal No. 2, you will bend the warp or hawser to the line, and they will draw it on shore, fearing to trust the boat to the small line. When the bend is made, and you are ready, make your signal No. 1, (which will be hereafter described, expressing *yes*.)

If, when you have got the line, the people on shore find you have not a warp ready, and wish you to haul on board by it a stouter rope to haul the boat off with, they will make signal No. 3, to *haul away*, for you to receive a stout rope; secure it as before directed, and make your signal No. 1, which is also to denote *you are ready*, or their direction is complied with.

Remark.—A boat, when it can be applied, is the promptest method of bringing a crew on shore. Upwards of twenty crews have been saved by them.

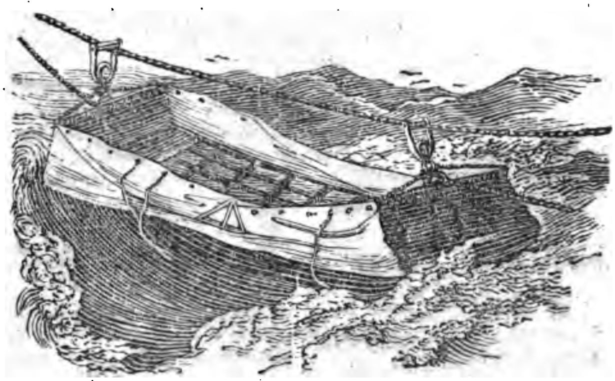
If, when you have received the line, and observe there is no boat at hand, and the signal on shore (No. 3) is made, you will haul in, and receive by it the end of a stout rope, and a tail-block rove with a small line, both ends of which are kept on shore; make the end of the stout rope and the tail of the block well fast round your mast, higher or lower as circumstances require, and the tail-block close below the large rope. On your making signal No. 1, denoting to have complied with the direction of having carefully secured the stout rope and tail-block, the people on shore will haul taut the stout rope, and place on it a snatch-block (with a sling hanging to it large enough to hold a man); and making the ends of the small line fast to the lower part of the snatch-block, they will work it to the ship, when, on a man getting into the sling, he will, by pulling down the slide or button, secure himself in,

and safely lashing himself by the waist to the upper part of the sling, prevent the possibility of falling out; and on seeing the clasp of the block forelocked,* make signal (No. 1), that all is *ready*, the people on shore will haul the man to the land, and in the same manner travel the snatch-block back, until every person is brought from the wreck, as here represented.



Remark.—Crews have thus been brought in safety from distances exceeding 240 yards from the shore, and also from wrecks to the top of a cliff.

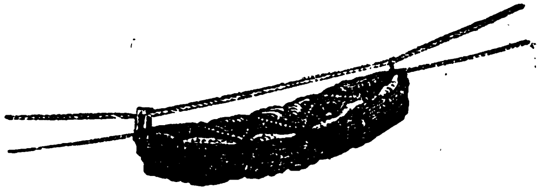
If the vessel stranded have women, children, sick or infirm persons, on board, who could not go aloft, instead of a snatch-block and sling, a cot, with lashings, to prevent persons



being washed out, may be worked in the manner just described.

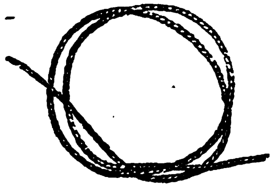
If the stranded vessel is driven among rocks, and the persons in danger of being killed or severely wounded from the surf dashing them with force against the rocky beach, a hammock, stuffed with cork parings or shavings, as here

* This remark is necessary, from the omission of the clasp being here represented, that should cross the mouth of the block.



represented, would protect them from injury.

If the people on shore have only the means of projecting a line for your preservation, they will make signal No. 4, for you to secure it, and draw on board so much as will fully reach from the vessel to the shore, to ensure a *continued communication;* with it make a clove hitch,

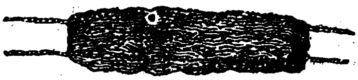


which is to be put over the shoulders and arms of those to be brought on shore, and draw it tight, in manner here represented; and on your making signal (No. 1), that you are *ready,* take care to *clear* the *wreck,* and

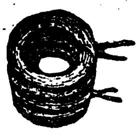
jump overboard, when the people on shore will instantly haul you through the surf in safety.

Remark.—Upwards of 50 persons have been saved in this manner, and among them one woman.

Should females or persons on board, from fear or agitation, be deprived of confidence in this mode of relief, a cushion, stuffed with fine cork parings, in the form represented, with lashings, so as to be easily ad-



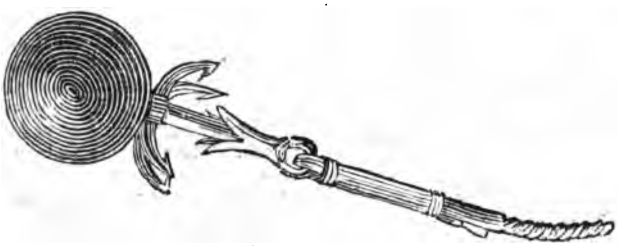
justed to the body, would make a floating belt, in this manner, and



effectually prevent the wearer from all danger or possibility of drowning.

Remark.—How important it would be to the preservation of life from shipwreck, if every owner of a vessel would consider it a duty he owes to humanity, to cause a hammock and cushions, stuffed as described, to be kept on board his ship! The expense would be a mere trifle, as cork shavings or parings are considered of little or no value; they would also be eminently useful in preventing a boat from sinking, by placing them under the thwarts.

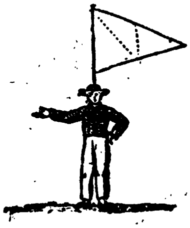
If the distance from the shore is too great for the mortar to be tried, or if the shot falls short of the vessel, bend your lightest and best stretched line to the buoy, veer it away gently, not paying out too fast; buoy up your line every twenty fathoms, if you can, with corks or small spirit kegs, or any thing you may have fit for the purpose; the buoy will not reach the shore, but it will drive near enough to enable them to throw a grapnell shot over



it, to draw it on shore; when this is done, look out for the signals as before, and be prepared in every way to obey them, and to act with the people on shore.

FORM OF SIGNALS FROM THE SHORE.

The signal man will stand clear of the crowd, and place himself in front of a small flag.



No. 1.—Are you ready—or look out for the rope; we are preparing to launch a boat to you.

No. 2.—Secure the rope; bend a warp or hawser to it, for us to draw it on shore for the boat—or for us to send you a stout rope, to be made fast to some firm parts of the wreck, for us to haul off a boat.

No. 3.—Haul away—to receive a stout rope, snatch-block with sling, cot or hammock.

No. 4.—Haul on board enough of the line to ensure a *continued communication*—take care to clear the wreck.

SIGNALS TO BE MADE FROM THE SHIP, IN REPLY TO ANY DIRECTION.

No. 1.—A man, in some conspicuous situation, will wave his arm three times horizontally or across him, to denote *yes*, or *ready*. If he has a hat, let him take it in the hand he waves.

No. 2.—Three times up and down, to answer *no*, or *not ready*.

I remain, Sir,
Yours, respectfully,
GEORGE WILLIAM MANBY,
Capt. Royal Barracks, Yarmouth.

WARM BATHING.

A HINT TO THE PROPRIETORS OF GAS WORKS.

SIR,—*The same fires which heat the retorts might prepare water for warm bathing*, and thus tepid immersion be made co-extensive with gas illumination. The beneficial effects of the warm bath are not generally known, otherwise it would be more universally adopted. Necessary to health, it is always a luxury, and is excellent in arthritic affections, while it agreeably evacuates the pores by carrying off condensed perspiration. Dr. Darwin recommends it as obviating, in a great measure, the usual effects of old age. But it unfortunately happens that those who most need it least enjoy it; yet it ought and might be put in the power of every individual, at a very trifling expense, by combining baths with gas establishments. The squeamish alone, those who more deserve drowning than bathing, would object to the neighbourhood of a gasometer. There are many towns where these ever-glowing retorts are established, and where the inhabitants, desiring neither the elegancies of the Romans, nor the luxurious immersion of the Turks, would, I have no doubt, patronise such bathing establishments as had utility for their object. I hope this will be considered by some public-spirited individuals; for, as Government has annulled the quarantine laws, which were the palladium of our rosy-cheeked islanders against the Levantine contagion, every attention ought to be paid to the means of preserving bodily health.

I am, Sir, yours truly,
THOMAS H. BELL.

Alnwick.

"PERPETUAL MOTION, AGAIN"—AN IMPRACTICABILITY.

SIR,—I cannot help admiring the good sense of your Correspondent "Nrubkcalb Cassi," in sending his communication to your instructive Magazine, instead of brooding over the idea for weeks and months in silence, to the injury of his health and waste of his valuable time.

About five or six years ago, a young man, a Scotchman, of considerable ability, stumbled upon this *attractive* plan of producing a perpetual motion. Confident of the truth of his principle, and giddy with the dreams of riches which he had been told would await the happy inventor of this long-sought desideratum in mechanics, he gave up all his emoluments in Scotland, and hastened to London, for the purpose of getting his machine constructed in a superior manner. The workman he employed was a Mr. Allen, then resident in the neighbourhood of Fetter-lane: the principle he employed was exactly similar to that of your Correspondent, but more complex in its application. After a lapse of some months the machine was finished, and, with beating heart, the magnet was applied to produce effects which should astonish the world; but, alas! how shall I describe it? It was at that moment discovered that the magnetic influence was exerted equally to the right and left, and that, instead of the pieces of soft iron, disposed at equal distances round the circumference, being only pulled or attracted *in one direction*, they were equally acted upon in the opposite, and consequently no motion ensued.

It is about three years since that another person, also a native of North Britain, proposed a new power to propel carriages on the road and ships at sea, and exhibited a model of his engine in Burlington Arcade, Piccadilly. It consisted of a wheel moved (as he pretended) by this selfsame principle of magnetism. The magnet, of a spherical form, was placed on a plate of metal, or, rather, mixture of metals (as he said), which had the rare power of *intercepting* the magnetic attraction, and consequently preventing the re-action which was fatal in the other case. I believe Mr. Gill took the trouble to expose this pretender, in his Technical Repository.

I had an opportunity, some time ago, of reading a letter from a person who had witnessed a similar invention, made by a Mr. John Spence, shoemaker, at Linlithgow, also in "Scotland's Isle." It consisted of a needle nicely balanced on a pivot, which was kept in continual motion by its poles being alternately attracted by two magnets, properly placed, and whose attraction was as regularly cut off through the intervention of *intercepting substances*, which Mr. Spence was represented as having spent twenty or thirty years in finding out.

It was also stated that he was, at that time, constructing an apparatus applicable to time-keepers, which he was going to present to the Royal Society, but, not having since heard of him or his intended communication to that learned body, I am afraid that Death has stept in, and *intercepted* him in his laudable pursuits.

Should any of your Correspondents know any thing of the fate of this person or his invention, it will, I dare say, be acceptable to many, but to none more than,

Your humble servant,

T. BELL.

2, Commercial-road, Whitechapel,
May 23, 1825.

ON PROTRACTED LABOUR IN COTTON FACTORIES.

SIR,—In an age like the present, and in a country abounding with means to cultivate the mind, as England undoubtedly does under the auspices of a free government, the system which is now generally acted upon in Cotton Factories, of compelling the operative spinners, their piecers, and other persons employed there, to work *fourteen* or *fifteen* hours per day, and tasking the operative spinners to a quantity of work beyond what is reasonable to be pro-

duced in a given time, is extremely injurious both in a moral and physical point of view.

It is notorious, in the cotton manufacturing districts, that persons therein employed are confined in an atmosphere polluted by their own respiration, by effluvia from their own bodies, and by impurities thrown off from the cotton and floating about in the room. In this situation, so much calculated for little bodily exertion, the spinners are kept in a state of continued activity, which necessarily produces fatigue, and, by daily repetition, this fatigue becomes excessive, and the vigour of the body is gradually exhausted; hence, debility, coughs, hoarseness, affections of the lungs, asthmas, consumptions, and rheumatic complaints, are so common, that it is remarkable to see a person working in a factory who does not labour under one or more of the above disorders. Callous must that man's heart be who can contemplate such scenes of human suffering and misery, and behold the spinner exerting himself, beyond his natural strength, from five in the morning till eight at night, and in some factories in this town and neighbourhood, as also at Low Moor, near Clithero, till nine at night. To see him not only so degraded as to work like a horse, but eating his meals like one! snatching a bite and a sup of his meals at intervals from the floor, or a board fixed at his wheels to hold his scanty allowance, as he runs from one wheel to the other, half naked, and reeking with perspiration! I say, callous indeed must that man's heart be who can contemplate such scenes with a stoical indifference. The benevolent and humane will shudder on contemplating the wretched and humiliating manner that the piecers are treated;—compelled to be unremittingly assiduous in their attention to their work—to eat their meals when cold and covered with dust, &c. for three or four days in the week—required to assist the spinners in cleaning the machinery during the intervals allowed for dinner time, and, in most factories, not allowed a spare moment to go to their breakfast.

Equally injurious, pernicious, and baneful, are the effects of this system on the morals of persons labouring under the aforesaid tyrannical yoke and present insufferable barriers to intellectual improvement! For how can it be expected that a man, after labouring incessantly 14 or 15 hours, with the exception of the intervals allowed for meals, can be in a capacity to spend any time in reading and writing, or endeavouring to acquire a knowledge of any of the useful sciences? Even allowing that he is able to read, and has the means in his power for self-cultivation, it is an axiom generally (perhaps universally) admitted, that the mind is so intimately connected with the body that one cannot suffer, but the other feels; therefore, when the man gets home at night, after he has eaten his supper, his body is so fatigued he is overcome with drowsiness, all the powers of his mind lay dormant, and he feels inclined for nothing but tired Nature's kind restorative—balmy sleep.

But, from experience and observation, I have every reason to believe there is not one in ten that can read tolerably, nor one in fifty that ever makes any proficiency in writing and arithmetic. Indeed, how can it be expected, when it is considered that, before the passing of Sir Robert Peel's Bill, in 1819, they commenced working at the factories before they were six years of age, and the major part before they were nine years, as was proved in evidence.

And even now, ever since that beneficial and solitary Act began to operate, many children, to my certain knowledge, do commence working in the factory before they are six years of age. Their parents not being able to keep them at home longer, on account of wages being so low, assert that the child is above nine years of age, in order to get them employed; and though, in most cases, a reference to the register for a certificate of baptism would prove that assertion to be false, the master or foreman is satisfied, and does not scruple to employ them.

There are, undoubtedly, a few individuals among the operative spinners who have been so fortunate as to obtain a little education, and, prompted, by reading a few useful books, especially the "Mechanics' Magazine," to study the principles of their trade, acquire a more perfect knowledge of useful arts and sciences, &c. But these have to rise early, perhaps at three or four o'clock every morning, in order to spend an hour in the improvement of their minds.

Such persons I have the honour to be acquainted with, but they are looked upon as something singular in a cotton factory. I do not hesitate to avow myself one of the number, having commenced working in a cotton factory when only five years of age, and continued in that occupation ever since, which is now above thirty-two years (16 of which I have been employed as a mule-spinner); and when I state that I have worked as an operative spinner at Manchester, Warrington, Bolton, Preston, Chorley, and Burnley, you will presume that I have something more than a mere superficial knowledge of the subject which I have been treating upon.

I have been an eyewitness of the direful effects of the system, and I heartily joined my suffering shopmates in petitioning the legislature in support of the Cotton Factory Bill, while pending in Parliament, in 1818 and 1819, and cheerfully contributed towards defraying the expenses of delegates and others, who were sent to London to give evidence in support of the same. I also acted as Secretary for a Committee appointed by the cotton-spinners and others to draw up the petitions, and transact all other business relative to the aforesaid Bill; and in this capacity I wrote several letters to Honourable Members of both Houses of Parliament, stating our grievances, and describing the appearance of the work-people in general—their pallid faces, and emaciated forms, squalid aspect, distortions, &c. respectfully beseeching them to support the Bill, that the sufferings of the children might be alleviated, and their condition meliorated. To some of these letters I had the honour to receive very polite and encouraging answers, and when that Bill was passed into a law (though the time of labour was, by a clause introduced in the House of Lords, augmented from eleven to twelve hours each day, which is longer than a due regard to the health, strength, and stature of the rising generation will permit, by at least two hours), I congratulated my shopmates on the happy result, and looked forward with joyful anticipation to having a little leisure for recreation and improvement. We expected, also, that parents would now have leisure and opportunity to instruct their children, and particularly the privilege of sending them to evening schools; but little did we think of the subterfuges that would be resorted to, in order to evade the provisions of the Act, or that we must be compelled, however reluctantly, to work three or four hours longer on Saturday than usual, in order to make up the time abridged from the other days, which has actually been the case in this and several other parts of the country. Very little attention is paid to that part of the Act which requires that the rooms should be ventilated, and the walls and ceilings whitewashed.—There are some manufactories in Burnley that have never been thoroughly whitewashed since the Act was passed! There are masters, too, that pretend to regard the Act, and observe all the regulations, &c. which it prescribes, who employ two or three spare hands to send all the children under sixteen out of the factory, at different times of the day, one hour, or more, according to the time the said factory works above the hours limited by the Act. The children are chastised if they stop away above the time allowed; and this practice is continued all weathers, summer and winter.

From what has been said, we may deduce the following inferences:—

1st. That the Act referred to has not produced those good and beneficial effects which the Honourable Author and the supporters of the Bill proposed and intended, but, by

leaving it at the master-spinner's option to work as long on Saturdays as the time limited for labour on other days, causes thousands of the poor working people, who are so unfortunately circumstanced, to profane the sabbath-day, by doing that on Sunday mornings which they were formerly wont to do on Saturday evenings, besides precluding them from going to the market to buy their provisions, &c.

2nd. That, as the Act prohibits magistrates from appointing visitors to inspect factories, &c. except in cases where complaints have been alleged, the proprietors and master-spinners may act with impunity, except in such rare cases as those stated in the *Manchester Guardian*, Nov. 13 and 27, 1824, where certain discarded and proscribed spinners are represented as having lodged informations against their employers, Messrs. Harrison, &c. for alleged breaches of the Act.

3rd. That it is requisite and necessary some alteration should be made in the Act of 59th Geo. III., "for the better Preservation of the Health of young Persons employed in Cotton Mills and Factories."

I therefore beg leave to suggest to the public, through the medium of your widely circulated publication, the propriety of petitioning the British Parliament to revise and amend the aforesaid Act; to authorise and enjoin the Excise-officer, or some other public functionary, of each district, to inspect all cotton mills and factories, and take cognizance of all breaches of the rules, as by law established; and, above all, to abridge the hours of labour on Saturdays, in order that the spinners and others employed therein may have the privilege of going to market, and attending to their domestic concerns, at the same time with people of other trades.

It is my decided and unbiassed opinion, that if the cotton factories were under the control of such disinterested and uninfluenced men as revenue-officers are, we should no more have reason to complain of the Act being infringed with impunity; and that, were the hours of actual labour for all persons employed in cotton factories so reduced as to leave them some little time for the cultivation of their minds, they would quickly rise buoyant from their depressed condition, and take their place among the most respectable classes of mechanics.

That this may be the happy result, is the sincere desire of,

Sir,
Your most obedient humble servant,
A Cotton-Spinner.

METALLIC COVERING FOR ROOFS.

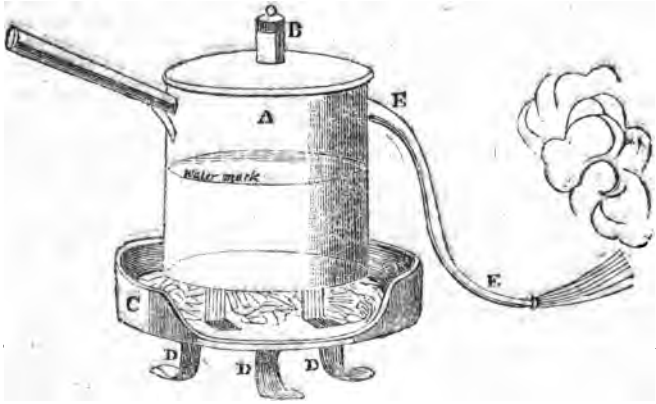
Sir,—Seeing that your Correspondent signed R. S. T. inquires who is the patentee for the metallic covering for roofs, I beg to inform him, as well as your Correspondents and subscribers in general, that you have been grossly imposed upon by Abel Handy, as no such patent has ever yet been granted. That there may not, at some future period, be one taken out, I do not presume to assert, nor do I question the merits or demerits of the Church referred to by A. H.; but that has nothing whatever to do with the subject of his letter, as the roof of that building is covered with common slate.

I am, Sir,
Your obedient servant,
A Berkshire Subscriber.
London Tavern, Bishopsgate-street,
19th May, 1825.

FRENCH DISCOVERY IN NAVIGATION.

A Company is forming in France for the establishment of vessels on the canals and rivers of that country; the wheels or paddles of which are stated to be set in motion by powerful air pumps, the action of which is continued by the action of the paddles. Great secrecy has been observed as to this invention; but the mode in which the machinery is first set into action is said to be by a powerful wheel almost without friction, which, although capable of producing an impulse equal to a forty horse power, is continued in motion by one person.

BUG-DESTROYER.



SIR,—If you think the above drawing of a Machine for destroying that obnoxious reptile, the Bug, and ridding houses of it in a clean, efficacious manner, it is very much at your service for the benefit of all who are troubled with this domestic affliction. I have destroyed and cleaned my bedsteads and house of these disagreeable inmates in the course of an hour and a half, without making any slops or soiling the least thing. I think it would be well if innkeepers, &c. would have a machine of this sort always in their house—the expense is only 2*s.* 6*d.*

I am, Sir, yours, &c.
G. BROWN.

Description.

A is a common tin saucepan, with the lid soldered down, to keep the steam in.

B, a tin pipe, in which a cock is put after the boiling water is put in.

C, a tin chafing-dish, fastened to the side of the saucepan to keep it above, so as to admit charcoal to be put under and lighted up, to keep the water boiling.

DDD, the legs on which the whole stands.

EE, a small tin pipe through which the steam flies, with great force, into the joints of the bedstead, under the sacking, skirting-boards in the room, or holes in the wall, burning up eggs, bugs, or every thing coming in its way. It can be carried by the handle, and the spout placed any where that bugs are supposed to harbour.

I assure you, Sir, though this simple contrivance may be laughed at, it is, nevertheless, as useful a piece of furniture as any in a house where these noxious vermin are troublesome.

MR. DICKINSON'S CLEANSING APPARATUS.

SIR,—In answer to X. X. (page 78, vol. IV.) I beg to state that I have never used my cleansing apparatus as a substitute for the gyle tun, but cleanse from the tun much earlier than the scientific brewer lays down *his* law for, and have not found any ill effect from a high fermentation. I never use a cover to the cleansing cap. Should X. X. be in London, I shall be happy to show him, or any person favouring me with a call, a very considerable improvement on its *conveniency.*

I am at a loss to know how the word *clearing* should have been substituted for *cleansing*, in all publications in which the apparatus has been noticed.

Your well-wisher,
R. W. DICKINSON.

Tything, Worcester, May 21.

BRIEF ACCOUNT OF GEOMETRY.

BY JAMES ELMES, ESQ. M.R.I.A.

From his Dictionary of the Fine Arts, now publishing in Numbers.

GEOMETRY. [*Geometria*, Lat. Γεωμετρία, Gr.] *In all the arts*, but more especially *in architecture*. The science of extension, quantity, or magnitude, abstractedly considered; demanding the greatest attention from the scientific artist.

"There is a certain degree of geometrical knowledge," says an able writer in Dr. Brewster's Encyclopædia, "which naturally arises out of the wants of man in every state of society. It is impossible to build houses and temples, or to apportion territory, without employing some of the principles of geometry. Hence we cannot expect to find a period of society or a country in which it was altogether unknown."

Ancient writers have generally supposed that it was first cultivated in Egypt; and, according to some, it derived its origin from the necessity of determining every year the just share of land that belonged to each proprietor, after the waters of the Nile, which annually overflowed the country, had returned into their ordinary channel. It may, however, be remarked, that the obliteration of the landmarks by the inundation is quite a conjecture, and not a very probable one.

Some writers, among whom is Herodotus, fix the origin of geometry at the time when Sesostris intersected Egypt by numerous canals, and divided the country among the inhabitants. Sir Isaac Newton has adopted this opinion in his Chronology, and has supposed that this division was made by Thoth, the minister of Sesostris, who, according to him, was the same as Osiris; and this conjecture is supported by some ancient authorities. Aristotle has, however, attributed the invention to the Egyptian priests, who, living secluded from the world, had leisure for study. Thus various opinions have been entertained respecting the origin of geometry, but all have agreed in fixing it in Egypt.

The celebrated philosopher, Thales of Miletus, transplanted the sciences, and particularly mathematics, from Egypt into Greece. He was born about six hundred and forty years before Christ, and being unable to gratify his ardent desire for knowledge at home, he travelled into Egypt at an advanced period of life, where he conversed with the priests, the only depositories of learning in that country. Diogenes Laertius relates, that he measured the height of the pyramids, or rather the obelisks, by means of their shadow; and Plutarch says, that the King Amasis was astonished at this instance of sagacity in the Greek philosopher; which is a proof that the Egyptians had made but little progress in the science. It is also stated by Proclus, that Thales employed the principles of geometry to determine the distance of vessels remote from shore. On his return to Greece, his celebrity for learning drew the attention of his countrymen; he soon had disciples, and hence the foundation of the Ionian school, so called from Ionia, his native country.

There were some slight traces of what may be called natural geometry in Greece, before the time of Thales. Thus Euphorbus of Phrygia is said to have discovered some of the properties of a triangle; the square and the level have been ascribed to Theodorus of Samos; and the compasses to the nephew of Dædalus. But these can only be considered as a kind of instructive geometry; the origin of the true geometry among the Greeks must be fixed to the period of the return of Thales. It was he that laid the foundation of the science, and inspired his countrymen with a taste for its study; and various discoveries are attributed to him, concerning the circle, and the comparison of triangles. In particular, he first found that all angles in a semicircle are right angles; a discovery which is said to have excited in his mind that lively emotion which is perhaps only felt by poets and geometers: he foresaw the important consequences to which this proposition led, and he expressed his gratitude to the muses by a sacrifice. This, however, is but a small part of what geometry owes to him; and it is much to be regretted, that the loss of the ancient history of the science should have left us in uncertainty as to the full extent of the obligation.

It is probable that the greater number of the disciples of Thales were acquainted with geometry; but the names of Ameristus and Anaximander only have reached our times. The first is said to have been a skilful geometer; the other composed a kind of elementary treatise or introduction to geometry, the earliest on record. Thales was succeeded in his school by Anaximander, who is said to have invented the sphere, the gnomon, geographical charts, and sundials; he was succeeded by Anaximenes; and this philosopher again was succeeded by his scholar Anaxagoras, who, being cast into prison on account of his opinions relating to astronomy, employed himself in attempting to square the circle. This is the earliest effort on record to resolve the most celebrated problem in geometry.

Pythagoras was one of the earliest and most successful cultivators of geometry. He was born about 580 years before the Christian era; he studied under Thales, and by his advice travelled into Egypt. Here he is said to have consulted the Co-

lumns of Sothis, on which that celebrated person had engraven the principles of geometry, and which were disposed in subterranean vases. A learned curiosity induced him to travel also into India; and it is far from being improbable that he was more indebted for his knowledge to the Brahmins, on the banks of the Ganges, than to the priests of Egypt. On his return, finding his native country a prey to tyranny, he settled in Italy, and there founded one of the most celebrated schools of antiquity. He is said to have discovered that, in any right-angled triangle, the square on the side opposite the right angle is equal to the two squares on the sides containing it, and, on this account, to have sacrificed one hundred oxen to express his gratitude to the muses. This, however, was incompatible with his moral principles, which led him to abhor the shedding of blood on any account whatever; and besides, the moderate fortune of a philosopher would not admit of such an expensive proof of his piety. The application which the Pythagoreans made of geometry gave birth to several new theories, such as the incommensurability of certain lines, for example, the side of a square and its diagonal, also the doctrine of the regular solids, which, although of little use in itself, must have led to the discovery of many propositions in geometry. Diogenes Laertius has attributed to Pythagoras the merit of having discovered that, of all figures having the same boundary, the circle among plain figures, and the square among solid figures, are the most capacious: if this was so, he is the first on record that has treated of isoperimetrical problems.

The Pythagorean school sent forth many mathematicians; of these, Archytas claims attention, because of his solution of the problem of finding two mean proportionals; also on account of his being one of the first that employed the geometrical analysis, which he had learned from Plato, and by means of which he made many discoveries. He is said to have applied geometry to mechanics, for which he was blamed by Plato; but probably it was rather for applying, on the contrary, mechanics to geometry, as he employed motion in geometrical resolutions and constructions.

Democritus of Abdera studied geometry, and was a profound mathematician. From the titles of his works, it has been conjectured that he was one of the principal promoters of the elementary doctrine respecting the properties of circles and spheres, and concerning irrational numbers and solids. He treated besides of some of the principles of optics and perspective.

Hippocrates was originally a merchant, but having no taste for commerce, his affairs went into disorder; to repair them, he came to Athens, and was one day led by curiosity to visit the schools of philosophy. There he heard of geometry for the first time; and it is probable there is a natural adaptation of certain minds to particular studies; he was instantly captivated with the subject, and became one of the best geometers of his time. He also was the first that composed Elements of Geometry, which, however, have been lost, and are only to be regretted, because we might have learned from them the state of the science at that period. It has been said that, notwithstanding his want of success in commerce, he retained something of the mercantile spirit: he accepted money for teaching geometry, and for this he was expelled the school of the Pythagoreans. This offence, we think, might have been forgiven, in consideration of his misfortunes.

Two geometers, Bryson and Antiphon, appear to have lived about the time of Hippocrates, and a little before Aristotle. These are only known by some animadversions of this last philosopher on their attempts to square the circle. It appears that before this time geometers knew that the area of a circle was equal to a triangle, whose base was equal to the circumference, and perpendicular equal to the radius.

Having briefly traced the progress of geometry during the two first ages after its introduction into Greece, we come now to the origin of the Platonic school, which may be considered as an era in the history of the science. Its celebrated founder had been the disciple of a philosopher (Socrates) who set little value on geometry; but Plato entertained a very different opinion on its utility. After the examples of Thales and Pythagoras, he travelled into Egypt, to study under the priests. He also went into Italy to consult the famous Pythagoreans, Philolaus, Timæus of Locris, and Archytas, and to Cyrene to hear the mathematician Theodorus. On his return to Greece, he made mathematics, and especially geometry, the basis of his instructions. He put an inscription over his school, forbidding any one to enter that did not understand geometry; and when questioned concerning the probable employment of the Deity, he answered, that *he geometrized continually*, meaning, no doubt, that he governed the universe by geometrical laws.

It does not appear that Plato composed any work himself on mathematics, but he is reputed to have invented the geometrical analysis. The theory of the conic sections originated in this school; some have even supposed that Plato himself invented it, but there does not seem to be any sufficient ground for this opinion.

These discoveries must be attributed

to the Platonic school in general; for it is impossible to say with whom each originated. Some of advanced years frequented the school as friends of its celebrated head, or out of respect for his doctrines; and others, chiefly young persons, as disciples and pupils. Of the first class were Loadamus, Archytas, and Theætetus. Laodamus was one of the first to whom Plato communicated his method of analysis, before he made it public; and he is said by Proclus to have profited greatly by this instrument of discovery. Archytas was a Pythagorean of extensive knowledge in geometry and mechanics. He had a great friendship for Plato, and frequently visited him at Athens; but in one of his voyages he perished by shipwreck. Theætetus was a rich citizen of Athens, and a friend and fellow-student of Plato under Socrates, and Theodorus of Cyrene, the geometer. He appears to have cultivated and extended the theory of the regular solids.

Passing over various geometers who are said to have distinguished themselves, but of whom hardly any thing more than the names are now known, we shall only mention Menæchmus and his brother Dinostratus. The former extended the theory of conic sections, insomuch that Eratosthenes seems to have given him the honour of the discovery, calling them *the curves of Menæchmus*. His two solutions of the problem of two mean proportionals are a proof of his geometrical skill. Several discoveries have been given to Dinostratus; but he is chiefly known by a property which he discovered of the *quadratrix*, a curve supposed to have been invented by Hippias of Elis.

The progress of geometry among the Peripatetics was not so brilliant as it had been in the school of Plato, but the science was by no means neglected. The successor of Aristotle composed several works relating to mathematics, and particularly a complete history of these sciences down to his own time: there were four books on the history of geometry, six on that of astronomy, and one on that of arithmetic. What a treasure this would have been, had we now possessed it!

The next remarkable epoch in the history of geometry, after the time of Plato, was the establishment of the school of Alexandria, by Ptolemy Lagus, about 300 years before the Christian era. This event was highly propitious to learning in general, and particularly to every branch of mathematics then known; for the whole was then cultivated with as much attention as had been bestowed on geometry alone in the Platonic school. It was here that the celebrated geometer, Euclid, flourished under the first of the Ptolemies: his native place is not certainly known, but he appears to have studied at Athens, under the disciples of Plato, before he settled at Alexandria. Pappus, in the Introduction to the seventh book of his Collections, gives him an excellent character, describing him as gentle, modest, and benign towards all, and more especially such as cultivated and improved the mathematics. There is an anecdote recorded of Euclid, which seems to show he was not much of a courtier: Ptolemy Philadelphus having asked him whether there was any easier way of studying geometry than that commonly taught; his reply was, "There is no royal road to geometry." This celebrated man composed treatises on various branches of the ancient mathematics, but he is best known by his Elements, a work on geometry and arithmetic, in thirteen books, under which he has collected all the elementary truths of geometry which had been found before his time. The selection and arrangement have been made with such judgment, that, after a period of two thousand years, and notwithstanding the great additions made to mathematical science, it is still generally allowed to be the best elementary work on geometry extant. Numberless treatises have been written since the revival of learning, some with a view to improve, and others to supplant, the work of the Greek geometer; but in this country, at least, they have been generally neglected and forgotten, and Euclid maintains his place in our schools.

Of Euclid's Elements the first four books treat of the properties of plane figures; the fifth contains the theory of proportion, and the sixth its application to plane figures; the seventh, eighth, ninth, and tenth, relate to arithmetic, and the doctrine of incommensurables; the eleventh and twelfth contain the elements of the geometry of solids; and the thirteenth treats of the five regular solids, or *Platonic bodies*, so called because they were studied in that celebrated school: two books more, viz. the fourteenth and fifteenth, on regular solids, have been attributed to Euclid, but these rather appear to have been written by Hypsicles of Alexandria.

Besides the Elements, the only other entire geometrical work of Euclid, that has come down to the present times, is his Data. This is the first in order of the books written by the ancient geometers to facilitate the method of resolution or analysis. In general, a thing is said to be given, which is actually exhibited, or can be found; and the propositions in the book of Euclid's Data show what things can be found from those which by hypothesis are already known.

In the order of time, Archimedes is the next of the ancient geometers that has drawn the attention of the moderns. He was born at Syracuse, about the year 287 A.C. He cultivated all the parts of

mathematics, and in particular geometry. The most difficult part of the science is that which relates to the areas of curve lines and to curve surfaces. Archimedes applied his fine genius to the subject, and he laid the foundation of all the subsequent discoveries relating to it. His writings on geometry are numerous. We have, in the first place, two books on the sphere and cylinder; these contain the beautiful discovery, that the sphere is two-thirds of the circumscribing cylinder, whether we compare their surfaces or their solidities, observing that the two ends of the cylinder are considered as forming a part of its surface. He likewise shows that the curve surface of any segment of the cylinder, between two planes perpendicular to its axis, is equal to the curve surface of the corresponding segment of the sphere. Archimedes was so much pleased with these discoveries, that he requested, after his death, that his tomb might be inscribed with a sphere and cylinder.

Eratosthenes was another great geometrician, and flourished in the Alexandrian school, about the time of Archimedes. He was born 276 A. C., and, as a geometer, ranks with Aristæus, Euclid, and Apollonius.

About the time that Archimedes finished his career, another great geometrician appeared, named Apollonius of Perga, born 240 A. C. He flourished principally under Ptolemy Philopater, or towards the end of that century. He studied in the Alexandrian school under the successors of Euclid; and so highly esteemed were his discoveries, that he acquired the name of the *Great Geometer*.

The names of several other great mathematicians of antiquity, contemporary with Archimedes and Apollonius, have come down to us; but they are more referrible to a distinct work on geometry alone, which is of too much importance to be condensed into a single article of a work like this. We must, therefore, refer our readers, who would inform themselves properly on this important guide to all excellence in art or science, to the following works:—

On the history of geometry, to Montucla, "Histoire de Mathematiques," second edition. Bossut's "General History of Mathematics," of which there is a good English translation. Dr. Hutton's "Mathematical Dictionary," second edition, 4to. Lond. 1815. Dr. Brewster's "Edinburgh Encyclopædia," to which we are much indebted in this article. The "Encyclopædia Metropolitana," and similar works.

On the elements and practice of geometry, "Euclid," of which there are many editions; the first is that of Ratdolt, 1482. Dr. Barrow's edition of all the books, and the "Data," and Dr. Horsley's of the first twelve, from the Latin versions of Commandine and Gregory, and the "Data," are among the most valuable. "Archimedes;" the best edition, of which are Torelli's, in Greek and Latin, Oxford, 1792; and Peyrard's French translation, Paris, 1808. The first edition of the Greek text was that of Venatorius, in 1544. Apollonius; all the writings that have been recovered of this celebrated geometer are—1. "The Section of a Ratio;" and, 2. "The Section of a Space," which were restored by Snellius, 1607; and by Dr. Halley, in 1706. 3. "Determinate Section;" Snellius restored these in his "Apollonius Batavus," 1601. There is an English translation by Lawson, to which is added a new restoration, by Wales, 1772. Simson has restored this work in his "Opera Reliqua, 1776; and Giannini, an Italian geometer, in 1773. 4. "Tangencies;" Vieta restored this in his "Apollonius Gallus," 1600. Some additions were made by Ghetaldus, and others by Alexander Anderson, in 1612. The labours of Vieta and Ghetaldus have been given in English by Lawson, 1771. 5. "The Plani Loci;" these have been restored by Schooten, 1656; and Fermat, 1679; but the best restoration is that of Dr. Simson, 1749. 6. "The Inclinations;" these were restored by Ghetaldus, in his "Apollonius Redivivus, 1607: to these there is a Supplement by Anderson, 1612; a restoration by Dr. Horsley, 1770; and another by Reuben Burrow, 1779. Theodosius and Menelaus, 1558, 1675, and an Oxford edition by Hunter in 1707. Proclus, "Commentarium in primum Euclidis Librum, libri iv. Latine vertit." F. Baroccius, 1560. Proclus has also been ably translated by Taylor, 1788. Eratosthenes's "Geometria," &c. cum annot. 1672. Albert Durer, "Institutiones Geometricæ, 1532. Kepler, "Nova Steriometria," &c. 1618. Van Culen, "De Circulo et Adscriptis," 1619. Des Cartes, "Geometrie," 1637. Toricelli, "Opera Geometrica," 1644. Oughtred, "Clavis Mathematica," 1653. James Gregory, "Geometriæ Pars Universalis," 1668. Barrow, "Lectiones Opticæ et Geometricæ," 1674; "Lectiones Mathematicæ," 1683. David Gregory, "Practical Geometry," 1745. Sharp, "Geometry Improved," &c. 1718. Stewart, "Propositiones Geometricæ," 1763. Thomas Simson, "Elements of Geometry," 1747 and 1670. "Select Exercises," by the same, 1752. Emerson's "Elements of Geometry," 1763. Lacroix, "Elémens de Géometrie Descriptive," 1795. Playfair, "Origin and Investigations of Porisms," Edin. Trans. vol. iii. Legendre's "Elémens de Géometrie," ninth edition, 1812. Leslie, "Elements of Geometry, Geometrical Analysis, and Plane Trigonometry," second edition, 1811.

To such as are entering on the study of geometry, the following works are particularly recommended:—Simson's "Euclid," Playfair's "Geometry," Legendre's "Géometrie," which is a clear and valuable elucidation of the science, and Leslie's "Geometry."

INQUIRIES.

NO. 122.—CASES IN COTTON SPINNING.—A.

Take two bobbins full of stuffing out of a set, being both of them slipped off at the same time, and having never been broken; put them into a roving billy, and place each at the roller at the same time, and if they continue to work, without ever breaking, till the whole thread is rove from the one, the other will have at least one or two yards left, and sometimes more.

A second case:—There are two roving billies, A and B; each has stuffings from the same frame; A is the finer roving, and has the least twist in it. Notwithstanding, it has been found, on reeling two caps spun on the same mule from two separate rovings, A and B, and spun at the same time, that the yarn spun from it is coarser than that of B.

Required the true cause and best remedy.

B.

In some spinning mules the cotton rollers are fixed on an equal height, in others the front roller is lower by one-eighth or one-quarter of an inch than the other two; and I have seen some that have the foremost roller higher at least one-eighth of an inch, perhaps, according to the ideas of the respective machinists as to the plan that would answer the best for the cotton, or fineness and quality of the yarn.

Secondly,—In some factories the foreman or overlooker has the foremost top rollers fixed exactly over the centre of the bottom rollers, in others a little more forward, and in a third more inclined to the back; and I have seen them in all the three different positions in one and the same factory, but spinning different numbers of twist and weft.

Required demonstrative proofs, which is the best system, and whether any alteration is requisite or necessary in spinning different qualities of cotton or different numbers?

C.

The weights on the spinning mule rollers are, for single boss, the dead weight; double boss, first, saddles and springs, second, saddles and levers, with a weight hanging at the opposite end of the lever.

Required, first, what weight ought there to be put upon the front and back rollers, distinctly and respectively, for the following numbers, distinguishing the twist and weft? Numbers 30, 40, 50, 60, 70, and 80 hanks twist; and Numbers 30, 40, 50, 60, 70, 90, 120, and 160 hanks weft.—Second, the true and correct method of finding the weight upon the back and front rollers distinctly, in such mules as have them weighted with springs and levers?

If I am so fortunate as to bring my contemporaries into the field of discussion on the above subjects, I shall not be the last (though, perhaps, the meanest and most unworthy) to communicate my simple ideas; and it is my cordial wish that the subjects may be discussed in a more candid and liberal manner than the question on Long and Short Screwdrivers. For my own part, I shall continue always open to conviction, and ready to acknowledge my errors and ignorance, and I hope to meet with reciprocal sentiments in others.

I am, Sir,
Your obedient servant,
J. Bowker.

(To be continued.)

Notices to Correspondents in our next.

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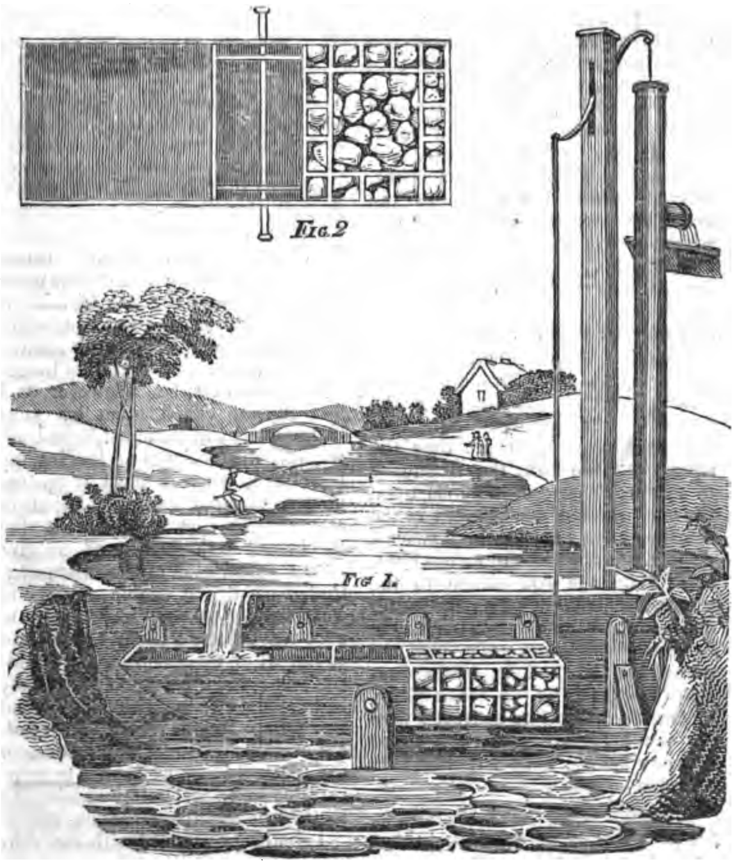
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 93.] SATURDAY, JUNE 4, 1825. [Price 3d.

" It is always requisite to think justly, even in matters of small importance."—*Fontenelle.*

PERPETUAL PUMP.



PERPETUAL PUMP.

Sir, — Travelling in a distant country, I observed, by the road-side, a horse-trough flowing over, being fed by a spout continually running: this spout was supplied by a Perpetual Pump, in a very small stream about a quarter of a mile distant, which I went to examine, and found it to be a contrivance so extremely simple in itself, and so useful in effect, that I take the opportunity of sending a description of it to you, thinking it may be worthy of a place in your valuable repository of mechanical knowledge.

The figure is so simple, it scarcely requires explanation. By the rough sketch prefixed, it is clearly perceived that two or more boards are placed across the stream, and held up by five or six stakes driven into the stream perpendicularly, and nailed to them: in the upper board (not exactly in the middle of the stream) is cut a notch for a spout, through which the whole of the brook or stream is conducted, and passes over as a spout into a sort of oblong box, whose outer end is formed somewhat like a shovel; when this is full, it overbalances the stones on the other side of the pivot, and, descending, instantly empties itself, and is as instantly brought to its former level by the stones in the frame on the opposite end. This process is repeated every time the stream fills the box, the frequency of which, of course, depends upon the magnitude of the stream; in the machine I saw, it was about twice a minute. As the crate of stones rises, it lifts up the rod affixed to the pump handle, and when the water on the other side is emptied, the weight of the stones pulls down the pump handle, and so keeps constantly performing. A continuation of troughs or gutters conveyed it to the place required, where it never ceased running, fully answering its intended purpose.

Two stakes are driven in the stream, for the axles of the machine to rest on, as in the figure.

Fig. 2 is a vertical or bird's eye view of the machine, with its axle lifted off the gudgeons.

I think this method is making the most of a stream of water, if it can have a foot fall, and, to all residents near brooks or small streams, it will be found highly convenient and useful, either for small fountains, or to fill cisterns, reservoirs, or ponds, above the usual level, &c. as the water may be carried to any height at pleasure.

I remain, Sir,
a lover of practical mechanics, and,
of course, a well-wisher to your
original and valuable publication,
Viator.

Kimbolton.

ON THE SLIDING RULE.

Sir,—Some time since I endeavoured to explain the construction and application of Gunter's Line, and should have extended the subject to the use of the same lines, as engraven on the Sliding Rule, had I not thought that some of your *practical* Correspondents would have been induced to take up the subject where I left it, as I am confident that those who are in the daily use of this instrument, are much more competent to give a familiar explanation, suited to the capacities of workmen in general, than I can be. However, as I find myself called upon by your Correspondent, "Monad," and always feeling desirous of lending my assistance, when I have it in my power, towards the elucidation of any subject that may benefit the mechanic, I shall proceed to give such a description of the instrument that, I trust, will enable any one to estimate its utility, and apply to practice Gunter's Line, as adapted to the art of measuring by the sliding rule; and I trust that my ready acquiescence to the wishes of Monad will induce him to favour your readers with the use and application of the sectoral lines, as applied to mensuration and mechanics, as also the method of their construction.

I shall now proceed with the subject, first remarking, that the term

"slide rule" is applied to a variety of instruments known under that title, such as Partridge's, Hunt's, Everard's, Coggershall's, &c.; but that most commonly in use is Coggershall's, and known by the general term of the carpenter's two-foot slide rule; and as that is the most simple, I shall give its use and application previous to that of some others, which are adapted to other purposes than performing the rules of multiplication, division, and extraction of roots. First, then,

Of the Construction of the Slide Rule.

This instrument consists of two pieces of box wood, each a foot in length, and connected together by a brass rule joint; one side or face of the rule is divided into twelve inches, and numbered; when the rule is open from 1 to 24, each inch is also subdivided into halves, quarters, and eighths (or half-quarters), the use of which speaks for itself; the remainder of this side of the rule is taken up in general with scales for planning dimensions. The rule I have before me contains only two scales on this face, the one an inch and a quarter scale, and the other an inch and a half; each of the large divisions, in drawing or measuring plans, are called feet, and one of these divisions in each scale is divided into twelve equal parts, corresponding to inches on the plan. The use of these scales is so obvious that it needs no illustration; but, for the sake of the young draftsman, I shall merely state that, in laying down a plan of any building or piece of work on paper, suppose he wishes to represent the distance of five feet six inches, he has nothing to do but to take from the scale a distance between the compasses equal to five of the large divisions and six of the smaller, and draw a line of that length on his paper; and if he wishes his drawing to be of such dimensions that one foot of the work required to be executed shall be represented on the paper by an inch and a half, he must use the scale marked $1\frac{1}{2}$, and so of all the other scales.

We will next observe that the thin edge of the rule is divided into, first, ten equal parts, which answer to the tenth part of a foot, and then these parts are subdivided again into ten equal parts also, which answer to the hundredth part of a foot; and thus we have the foot decimally divided, (and which, by-the-bye, we have to regret is not the general practice, as it would much shorten calculation, and be less burdensome to the memory than the present system of dividing the foot into twelve equal parts). These decimal divisions on the rule are continued along the two legs of it, and thus we have the whole length of two feet divided into 200 equal parts.

We now proceed to the other face of the rule, and which it is the chief object of this paper to describe. One leg contains a continuation of the scales for planning, from one quarter of an inch to one inch to the foot: on the other leg is the division more especially under our consideration, and which I shall endeavour to describe as familiarly as possible, that their nature, being well understood, will contribute to the thorough knowledge of their use and application. On this face are four lines, marked A, B, C, D; the three uppermost of which, marked A, B, C, are exactly similar to the lines on Gunter's scale, being the logarithms (or artificial numbers) from one to ten, twice repeated (see the description of this line, page 157, vol. III. of this Magazine), and which it is, therefore, unnecessary here to describe. The first of these lines, A, is engraven on the rule itself; the two next, B and C, are engraven on a brass or wood slider, and are exactly similar to the line A; and these three lines are called double lines, as proceeding from unity to ten, and twice repeated: the fourth line, marked D, is a single logarithmetic line (similar in its properties to the other lines), and is the representation of the logarithms of the numbers, the *proportional* lengths of which are double those of the lines A, B, and C, thus answering to cubic measure or solid content of bodies; whilst the other lines, A, B, C, answer to superficial measurement, as it is well known that the logarithm

of a number, multiplied by two, represents the logarithm of the square of the number that the first logarithm represented. This line, D, is also called the *girt line*, from its use in finding the content of round tim ber or trees, by taking their circumference round with a string, as in the common method in use, though it must be allowed it is not very exact.

In the use of this *rule* it will be necessary to bear in mind, that when 1, at the beginning of any line, is accounted 1, the 1 in the middle must be reckoned 10; and when the 1 at the beginning is reckoned 10 or 100, the 1 in the middle must be reckoned 100 or 1000, and so on, and all the other divisions in the same proportion.

G. A. S.

(*To be continued.*)

ON FLINT AND DETONATING LOCKS—SHAPE AND QUALITY OF GUN-BARRELS—CLEANING LOADED GUNS, ETC.

Sir,—Telloc Trigger, in Number 90 of your Magazine, describes a gun to be seen at Blanch's, gunmaker, as an invention "surpassing all others," &c. Neither Telloc Trigger nor yourself were probably aware, that a Frenchman, of the name of Pauly, claims the invention he alludes to. Guns, rifles, and pistols, are now made at Paris on this plan, either to load at the breech or muzzle. They are liable, however, to several objections; in particular, they are not water-proof, as the rain runs down the barrel through the hinge, and wets the detonating powder.

As I suppose, Mr. Editor, your object is to give information to the public in your Magazine, and not to publish bare assertions, I send the above, and enclose also a few remarks to your Correspondent, Mr. E. Wightman, Malton.

To Mr. E. Wightman, Malton.

Sir—In your answer to Number 97, Questions on Gunnery, you give a table of proportional charges for guns of different calibres; but as you mention that the *quality* of the barrel makes a material difference in the charge, I beg you will add *how* you discover *this difference*. It strikes me, that if two barrels are the same in length and bore, and straight, that they must require the same charge, whether the barrels be made of welded needles, or hoop-iron, or cast-iron, or brass. Again, I do not see why a barrel should shoot the better for being thick; that is, a barrel as thin as writing-paper should shoot as well as a barrel half an inch thick, provided the force of the powder do not make any *permanent* alteration in the size of the bore. I understand it is usual to enlarge gun-barrels (to shoot shot) towards the muzzle, to make them shoot close, as well as to enlarge them at the breech, to make them shoot strong. It would materially add to the value of your tables, and I will thank you to inform me if this practice is usual, and to point out how much larger or smaller at the muzzle and breech, barrels may be made to advantage; as also how much barrels should increase in length and weight with their increased bore, beginning with a half-inch barrel, and increasing one quarter of an inch at a time, until you reach a two-inch swivel duck-gun. I will trouble you also for a *good practical rule*, to prove whether a barrel is perfectly straight or cylindrical in the inside.

In your tables you give a charge for sixty yards. I have always understood that the best guns should not be depended upon to hit, that is, to put one grain of shot into a common playing-card at forty yards. Perhaps you will mention how many grains can be put into a mark of that size, or a circle of six inches diameter, at sixty yards, and the sized shot.

I am, Sir,
Your obedient servant,

O.

Sir,—I should be much obliged to your valuable Correspondent, Mr. Wightman, if he would inform me what is the best method of cleaning

a *loaded* gun, so as to remove the lead most effectually without injuring the barrel, and whether hot or cold water is best for washing it.

I observe Mr. Wightman states, that a percussion-gun kills ten yards farther than a flint-gun; but I have been told the reverse, both by gunmakers and sportsmen, who asserted that they had made accurate experiments, by trying the same barrel with flint and percussion locks, and that the former had decidedly the advantage in strength of shooting. Mr. W., or any other of your Correspondents, would confer a favour upon sportsmen, if he would give such *proof* of his assertion on this point, as might settle the dispute between flint and percussion.

HAMMER.

Flintshire, May 18th.

SIR,—The many and conflicting arguments which are daily held on the merits of the detonating principle, have induced me to trouble you with the following Schedule, which at once proves the superiority of the percussion gun over the common flint. Though my statement differs from a late treatise on guns, shooting, &c. by an experienced shot, I beg to say, that it is the result of many experiments; and I feel confident when I assert, that they will be found correct and impartial observations.

I remain, Sir,

Yours respectfully,

TELLOC TRIGGER.

May 20th, 1825.

Trial of a Gun with Flint Lock, 14-in. guage, 40 yards, at 15-in. sheet of paper.	In the 1st sheet.	Thro' the 15th do.	Same Gun, with the Detonating Principle appplied to it. In the 1st sheet.	Thro' the 15th do.
Round 1st . .	73	42	89	45
2nd . .	116	62	137	62
3rd . .	134	75	144	103
Total .	323	179	370	210
Majority in favour of the Detonator .			47	31

CASES IN COTTON SPINNING.

SIR,—Being a subscriber to your interesting and instructive miscellany, the Mechanics' Magazine, from which I have derived much instruction (particularly in the articles on geometry), I have for a long time been anxiously expecting to see something more immediately connected with the machinery employed in cotton factories, but have hitherto been disappointed, except in one or two instances. As I am aware there are several of your subscribers in Manchester, and various parts of Lincolnshire, employed as overlookers of different departments in cotton factories, it is my humble opinion that both mechanics, machinists, and overlookers of mule-spinners and card-rooms, might add to their own stock of knowledge and practical experience, and greatly accelerate the improvement of their machinery. And surely no person can entertain so absurd an opinion, as that the art of manufacturing cotton wool into yarn is brought to perfection, but will rather concur with me, that great improvements may yet be made in the construction of the machinery, and in the different operations of cording, drawing, and spinning, by communicating, through the medium of the Mechanics' Magazine, their ideas; proposing and answering difficult questions, stating and solving problems, and showing the correct calculations to regulate the speed, &c. of the various branches, from the carding-engine to the mule-spindle. Therefore, in order to stimulate such of my brethren in the trade as are qualified to discuss the

subject, I am induced to send you the following problems and questions for insertion in the Mechanics' Magazine; hoping they will take the hint given by Dr. Gregory in the motto to one of your Numbers (No. 69), and not only send answers and solutions to the subsequent articles, but continue to communicate matter more essentially necessary to be understood by every practical man at the head of cotton factories and machine shops. I know by experience, that there are men at the head of spinning-rooms and card-rooms who neither understand carding, drawing, or spinning, nor the rule to make correct calculations. The consequence is obvious; most part of the yarn is spoiled, being unequal and twisted. When any alteration is required in the system, or the spinning-masters are ordered to charge 20 or 30 hanks per pound, they cannot count to the point within four or five hanks. Such men have imposed on their employers, by pretending to understand the business, agreeing to serve for less wages than they could engage a man properly qualified both in theory and practice. The master does not see his error until he has lost his customers. The following queries may perhaps appear ridiculous to some of your intelligent and ingenious readers, but I can assure them, some of them have puzzled me for several months, before I found out the true cause and proper remedy; and I am not certain that much further light may not be thrown upon them.* Hoping this will be the commencement of a series of articles, which may have a tendency to facilitate the improvement of the art of cotton-spinning,

I remain, Sir, yours. &c.

AN OVERLOOKER.

PRIZE CHRONOMETERS.

SIR,—I take it for granted, that when Government first proposed that Chronometers should be received upon trial at the Royal Observatory, Greenwich, they meant thereby to encourage the real makers of those machines, and not the mere tradesmen by whom they might happen to be vended. This, however, has not been done; for, last year, a prize was given to Mr. Murray, of Cornhill, and this year, another has been given to Mr. French, of Sweeting's-alley, neither of whom, however respectable they may be as dealers and chapmen, ever made a chronometer himself. To give them the prizes, therefore, or, indeed, to allow any man, who is not known to be a real maker, to compete, is little less absurd, than if the prize were given to the deputy astronomer for that chronometer to which he pays the most attention.

Your publishing this may be the means of procuring justice for

REAL WORKMEN.

Clerkenwell, May 18, 1825.

[We think it is due to truth and justice to insert the above, but hope it will be in the power of Messrs. Murray and French to rebut successfully the charge brought against them.—ED.]

WHY IS A CARRIAGE LIGHTER WHEN IN MOTION THAN AT REST?

SIR,—I much suspect, as one of your Correspondents seems half inclined to do, that the question of a Carriage being lighter in Motion than when at Rest, is something similar to King Charles's question about the eels; notwithstanding the fact about skating over thin ice, and the resolution of forces, as explained by G. A. S. It is well known, that when a body moves diagonally under the influence of two forces, at right angles to each other, each impulse preserves its full effect, when estimated in a line parallel to its former direction. Hence the tendency of the moon to fall towards the earth in its orbit, though sustained there by the projectile force, and the curve it is thus compelled to describe, is just as great as if it were at full liberty to fall, by that projectile force being withdrawn. Upon this property the calculation of the true balance of these powers is made. If a cannon-ball be projected horizontally, with a velocity of ten feet, over a high cliff, at the end of the first second it will be found ten feet from the cliff, and about ten feet below it; at

* The queries here alluded to were, by mistake, inserted without this introduction in our last Number, where they will be found under the head of "Inquiries," No. 122—"Cases in Cotton Spinning."

the end of two seconds it will be found at twenty feet from the cliff, and sixty-four feet below it; and thus it will appear, that both powers operate without either diminishing the other. If any one will examine thin ice breaking under too heavy pressure, he will perceive that it is a progressive, and not an instantaneous action. It bends first to a considerable extent, and receives an additional support from the water thus displaced under it, like a shallow boat; the pressure continuing, it begins to crack in lines, radiating from the point where the force is exerted; when these have proceeded to a sufficient extent to have leverage enough, notwithstanding the counteracting increase of width of the pieces intercepted between these radii, the whole breaks in by a fracture nearly circular. In proportion as there is a greater disparity between the force applied and the resistance, this process goes on with more rapidity; when the powers are nearly balanced, I have seen ice sustain weights for a second or two that it broke in with; in fact, the process of breaking occupied this time. Hence, if a man skating over ice too thin to sustain his weight resting long upon it, quits his place continually before the process is completed, he does pass over ice that may be said to be too weak to sustain his weight; but the fact arises from the slow, counteracting process, and no other cause. Time is a necessary element in all calculations of force. A shot will cut a piece out of a board suspended by a string, and scarcely stir the board; thus the firm attraction of the particles of the wood give way, apparently without effort, because attraction is a thing measured by the time it operates; but it is equally effective during every portion of it, and the amount of the whole in a given time is a given sum. If a carriage occupy one second in going over the flat board of a weighing-machine, it will distribute as much pressure over the whole length as it would have applied to any one point of it, on which it stood still during the same time. Hence I conceive the Carriage Question may as well rest as be kept going.

I am, Sir,
Your obedient servant,
G. C.

ON THE SAME QUESTION.

From another Correspondent.

SIR,—It is a well-known principle in mechanics, that when two bodies impinge against each other, the mutual actions of one body against the other are invariably equal. By this action the parts of the bodies yield inwards, but immediately return to their figure by their natural elasticity.

For instance, if a body, B, whose velocity is 12, impinge against A, in a state of rest, and whose mass is to that of B as 3 : 1, the direction of the motion originally impressed upon the body, B, will be changed after the stroke, and it will return with the velocity of 6. In this instance we suppose B and A to be perfectly elastic; but as we are unacquainted with any bodies possessing this quality in so perfect a degree, allowance must, of course, be made in speaking of natural bodies; those which approach the nearest to this perfect state of elasticity, admitting more immediately of the application of the general rule.

We will endeavour to apply this rule to the question under consideration. When the ball is in a state of rest upon the weigh-bridge, the latter body, after the elasticity generated by the first impression (viz. the impression exerted by the ball in the act of being placed upon the bridge) has subsided, is then acted upon only by the force of gravity, which acts equally and every moment of time near the earth's surface.

If the ball be thrown down upon the bridge with the velocity of 12, the mass of the bridge being to the mass of the ball as 3 : 1, the ball will rebound, and return with the velocity 6 (supposing the force of gravity suspended); but supposing the force of gravity existing, it must be subtracted from the last-mentioned velocity.

In this case it is evident, that immediately after the stroke, and during the action of elasticity, not only is the force of gravity insensible, but absolutely overcome, and a motion impressed upon the ball in a direction contrary to the first.

This case is easily applicable to that of the ball rolling over the bridge, the motion of which may be considered as a succession of strokes, the momentum of each being equal to the force of gravity.

If the velocity of the ball generated by gravity, for argument sake, be supposed equal to 12, and the masses bearing the same proportion as above, gravity would then, of course, be insensible, and the bridge would be under no impression; but as neither of the masses bear this proportion, or the velocity of the ball the same as above, the general result must, of course, be different.

It is upon this principle that a carriage suspended on springs moves with less resistance over a road, than would a carriage of like bulk without springs.

I am, Sir,
Your obedient servant,
H. W. B. N.

Woolwich.

PLAN OF A SIMPLE STEAM-WHEEL.

Fig. 1

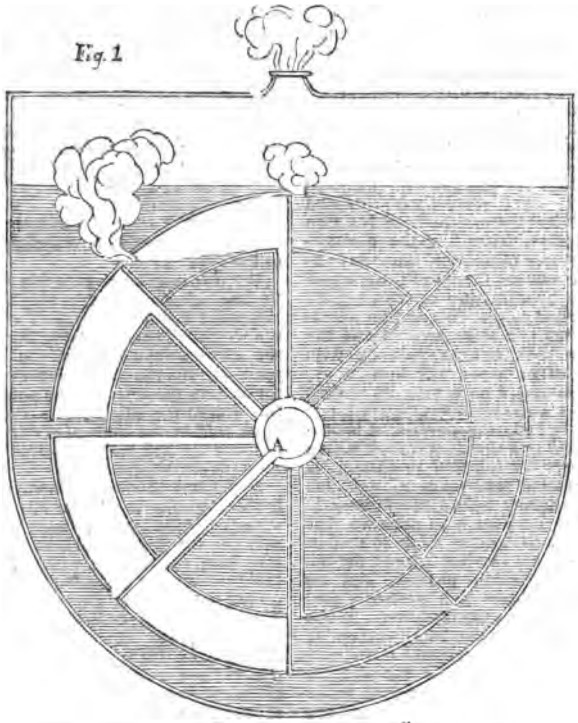
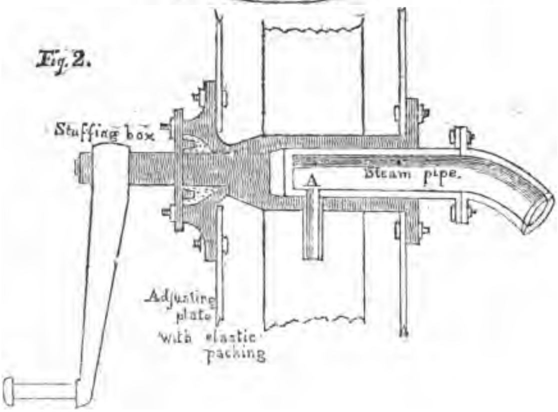


Fig. 2.



SIR,—I send you the plan of a Steam-Wheel, the model of which I set to work in Mr. Boulton's laboratory, at Soho, about twenty years ago. A remarkable coincidence occurred on that occasion. Whilst the engine was at work, Mr. Boulton was called out of the room; on his return, he informed me that he had been requested by an American gen-

tleman to give his advice on the same invention, and that one of us must have borrowed it from the other. This, however, proved not to be the case; and, on more minute examination, there appeared a considerable difference in the mode of constructing the American engine, though acting on the same general principle as my own. From that time to this, I believe neither of these engines have ever been applied to any use, though a patent was obtained for the American engine, which was, I think, the best of the two, if used with water only. I conceive, however, that these engines are so simple in principle, and so cheap and durable, that, on many occasions, if generally known, they would be applied with great advantage. The power of them is derived from the tendency of light bodies to float when immersed in heavy fluids, or, to speak more correctly, of the heavy fluids to displace them.

Fig. 1 exhibits a wheel divided into cells, and placed under heated mercury, or that mixture, of eight parts of bismuth, five lead, and three tin, which is fluid at the temperature of 212°; or, where waste of fuel and loss of space are no great objects, placed only under boiling water. Each of these cells is connected by any appropriate means with a steam pipe, so that each receives the steam; when at the bottom, the floating power then brings the other cells in succession to be filled with steam, and the wheel is thus put into full action. Where the expansive force only is used, the steam escapes from the top of the trough; but if this be connected with a condenser and air-pumps, as usual, the full power will be obtained with the metallic fluids. Each cubic foot of steam, in water, will give about 60 pounds of power; in the metallic mixture, about 600 pounds; and the velocity with which this supply can be afforded, and the height it can rise, will give the remaining elements for calculating the power of the engine. As the steam will expand as it rises up in the buckets, no more should be allowed to enter than will fill them when at the top of the wheel. The metallic mixture is subject to oxidation by the hot water, in some degree, but it may easily be restored again, by melting the oxide under tallow. When water only is used, the whole machine may be made of wood, in the form of a common bucket water-wheel; a steam pipe is introduced through the bottom of the trough, just under the side of the wheel where the buckets are inverted, when they become filled with steam in succession, and thus a stream of steam effects as much, bulk for bulk, as a stream of water. This is the form of the American engine.

Fig. 2 is a plan for admitting the steam into the pipes leading to the cells, but many better modes might be adopted; this is, however, sufficient to explain my engine. It is scarcely necessary to mention, that the steam tubes should be covered up by circular plates on each side of the wheel, to obviate the resistance in passing through the fluid.

I remain, Sir,
Your obliged servant,
G. C.

IMPROVEMENT OF WHEEL CARRIAGES.

Sir,—Your Correspondent signing himself R. E. (p. 103, vol. iv.) inquires, whether any benefit would be derived by a horse in drawing a gig by shafts, connected to the other part of the carriage by a resisting spring, in order, as your Correspondent says, "to relieve him at starting, and on meeting with any obstructions on the road." Now, Sir, I apprehend the very reverse of ease would be the consequence of such an alteration; as the horse would then have to overcome the resistance of the spring, in addition to that of the carriage, and his whole labour would be further increased by the unsteady purchase it would create. My ideas for an improvement in the draught of gigs, would suggest an immediate connexion of the shafts to the axle-trees, thus dispensing with traces; and by allowing the line of draught to be quite straight, and at a proper angle, it would tend to prevent much useless

labour to the animal, and much unnecessary strain upon the wood-work.

While upon this subject, I am anxious to know the opinion of some of your Correspondents upon double or under-springed carriages. They seem to me well calculated to preserve the carriage part, but I think, besides the extra weight, that they add to the difficulty of draught; inasmuch as any person sitting in the inside of the chariot will perceive, upon passing any obstacle, that he is subjected to a second rocking or undulation before the first has ceased, and that the horses have increased labour till they receive their steady pull. This inconvenience might, perhaps, be diminished by having the under-springs longer, so that they, as well as the whip-springs, might get into action, and again become quiescent at the same time.

I am, Sir,

Your most obedient servant,

D. P. Bungy.

REPLY OF MR. WAY, ON CEMENTING WATER AND STEAM-PIPE JOINTS.

Sir,—Your nameless Correspondent, who writes from Bow (p. 389, vol. III.), calls himself a "Practical Engineer;" but without better authority than his letter, I should doubt his claim to the title he assumes. When I had stated so distinctly, that the water was pumped into a reservoir, about 900 feet from the greatest extent to which the water was brought; that pipes of three inches in diameter were used; that part were flanged, and part spiggot and faucet; and that the water was raised in my house from the pipes, through lead ones, a height of about eight feet; if he had been what he pretends to be, he would have required no other information to enable him to calculate the pressure of water upon the joints; which, for me, who am not a *practical* engineer, might possibly have proved a more difficult task. He must also, I think, have been aware that, as the easiest way to fill the reservoir, the water would be pumped into it at the top, on the side nearest the well; and that, for the sake of economy, it would be conveyed into the pipes, by fixing them at the bottom of the reservoir, nearest the house, and, of course, not connected with the pump; and that the pipes would, when laid down, remain fixed and immoveable. There were various forks in some of the pipes, on the right and left sides, in case a supply of water should afterwards have been wanted in those directions; those were plugged, and never used; the water was taken from the pipes at three different places, about 100 feet apart, by orifices left in the upper surfaces of the pipes. What jar or shake the pipes could feel from the velocity of the water passing through them, I am quite at a loss to find out, as the pipes would always remain full, except when water was drawing from them; and as that was from lead pipes, and cocks of about an inch in diameter, it would be scarcely felt on pipes of three inches bore. Your Bow Engineer states, that he uses iron borings pounded, which must be difficult to be got in most places (I fear he means to *bore* your Henley inquirer). To be sure, iron filings can be got in most country smiths' shops; but then these cannot need pounding. The place where my pipes were laid down was very near to the yard of a shipwright, who did a good deal of work, and for more than thirty years I was very frequently in the yard, viewing vessels building and caulking, and I have some little idea how the latter work is done, but I can form no conception how such a substance, as your Bow Engineer describes, can be caulked into the ends of the joints of iron pipes. I am certain it cannot be by what the caulkers call their art and mystery, namely, drive and go; if it is, cast iron pipes would soon go to atoms. I cannot here lay my hand on the directions given me by the agent of the Neath Abbey iron-foundry for a luting, where that is requisite, and at this distance of time I cannot remember all the materials of which it was composed: borax was one of the principal articles, but I am certain there were no iron borings in it, as recommended by your Correspondent. Between us, however, I dare say we shall afford sufficient information for the purpose of your Henley Correspondent. In my letter, I certainly had no idea of giving information to *real practical engineers*, being well aware that they were too well informed for any thing I could write to be of the slightest use to them; I considered (as I stated nothing but plain facts, and those in the plainest way) that if they found a place in your very valuable publication, they might afford some useful hints to persons in the same situation in which I was placed, as well as to such sort of mechanics as I then employed.

The friend who supplied me with the Roman cement I used, has been dead some years; but I have before me a letter from his only surviving son, dated the 7th of March, referring me to your

Magazine for a description of an engine he meant to examine, "which (he adds) I see, by a letter in a Number of last month, you occasionally look into. Thomas Everett came into the counting-house one day, and I gave it him to read. He is highly pleased to find his name in print. I have employed him for several years, and I do not think there is a more honest man in existence, nor one that has your interest more at heart while working for you." This gentleman was born, and has always lived, in the parish in which my pipes are laid down.

I am, Sir, yours, &c.

A CONSTANT READER AND SUBSCRIBER.

CALCULATION OF INTEREST AT FIVE PER CENT.

Multiply the sum by the days, and divide the product by 365, the quotient will be the answer in shillings. Query, Why is it so?

l.	*days.*	*l.*	*l.*	*days.*	*s.*
100 ..	365 ..	5 : :	25 ..	219 ..	15

```
365               219
-----             -----
36500             1095
                  438
                  -----
                  5475
                     5
                  -----
       36500) 27375 (0
                  -----
```

Here we find the product of the antecedents greater than that of the consequents, and we must proceed to bring the latter into the next lower denomination, which, being shillings, we multiply by 20.

```
          27,375
              20
          -------
365,00)  547,500  (15s. true ans.
          1825
          -------
          ......
          -------
```

We first multiplied the product of the sum and days by the factor 5, and then multiplied that product by 20, but $x \times 5 \times 20 = x \times 100$; therefore, referring to our original statement, we may make a new one, as follows:—

	days.	*shillings.*	*l.*	*days.*
100 ..	365 ..	100 : :	25 ..	219

But the first thing which strikes the scientific observer's eye is, the first antecedent is equal to the first consequent, and therefore may be both exterminated without altering the proportionality of the analogy as to number—

days.	*l.*	*days.*
365 ..	25 : :	219

To meet my view of the true principles of proportion, we must make an alteration in the relative positions of the above remaining terms, viz.—

days.	*days.*	*l.*
365 ..	219 : :	25

```
          219
           25
         -----
         1095
         438
         -----
  365)  5475  (15
        1825
         -----
          ...
         -----
```

It is here very evident that the quotient 15, found as above, must be 15*l.* sterling, therefore cannot be the true interest sought; but as some sensible gentleman may have discovered that the true answer was 15 shillings, he very shrewdly suggested, as a short cut, 15 = 15; therefore *call* the quotient *shillings*, and you will be right.

This being a *mechanical* mode of obtaining scientific results, induced me to think it may be particularly applicable to your widely-circulating and useful publication; allow me, therefore, to endeavour to explain all this to you. Let x equal the interest of *one hundred* pounds for *one* day; if the *one* hundred pounds be forborne for *ten days*, the interest will be *ten times* x. If *ten* hundred pounds be forborne for *one* day, and that the interest of *one* hundred pounds for *one* day equals x, *ten* times x must be the interest, the same as in the case of *one* hundred pounds for *ten* days, and we at once obtain the following corollary:—If any number of pounds be multiplied by any number of days, the product will be a sum, the interest of which for one day will be equal to the interest of the given sum for the given days. Now, on referring to our last analogy, we may read it thus:—As the whole year is to the number of days forborne, so is the principal sum to the fourth proportional, which shall be the sum,

the interest of which for the whole year shall be equal to the interest of the given sum for the given portion of the year; and we may demonstrate this from the well-known property of an analogy, viz. the product of the extremes is equal to the product of the means :—

365 ..	219 ::	25 ..	15
15	25		
1825	1095		
365	438		
5475 =	5475		

That is, the interest of fifteen pounds for 365 days is equal to the interest of twenty-five pounds for 219 days. We have been searching for a thing required, and we have found a thing equal to it, which will answer our purpose as well as the original.

We were asked, what is the interest of twenty-five pounds for 219 days? and we have discovered that the interest of fifteen pounds for one year is equal to it; but the rate per cent. given is five: and it is evident that the rate five is the twentieth part of the principal sum, one hundred; therefore the interest of any sum for one year must be the twentieth part of itself; hence, the interest of fifteen pounds for one year, being equal to the interest of the given sum for the given days, we obtain the result by taking the twentieth part of fifteen pounds, viz. fifteen shillings.

Interest of 15*l.* for 365 days . . 15*s.*
25*l.* for 219 days . . 15*s.*
2475*l.* for 1 day . . 15*s.*

R. Dowden.

Cork.

VARNISH USED FOR INDIAN SHIELDS.

Shields made at Silhet, in Bengal, are noted throughout India for the *lustre and durability of the black varnish* with which they are covered. Silhet shields constitute, therefore, no inconsiderable article of traffic, being in request among natives who carry arms, and retain the ancient predilection for the scimitar and buckler. The varnish is composed of the expressed juice of the marking-nut, *semecarpus anacardium*, and that of another kindred fruit, *holigarna longifolia*.

The shell of the *semecarpus anacardium* contains between its integuments numerous cells, filled with a black, acrid, resinous juice, which likewise is found, though less abundantly, in the wood of the tree. It is commonly employed as an indelible ink, to mark all sorts of cotton cloth. The colour is fixed with quicklime. The cortical part of the fruit of the *holigarna longifolia* likewise contains between its lamina numerous cells filled with a black, thick, acrid fluid. The natives of Malabar extract by incision, with which they varnish targets.

To prepare the varnish according to the method practised in Silhet, the nuts of the *semecarpus anacardium*, and the berries of the *holigarna longifolia*, having been steeped for a month in clear water, are cut transversely, and pressed in a mill. The expressed juice of each is kept for several months, taking off the scum from time to time. Afterwards the liquor is decanted, and two parts of the one are added to one of the other, to be used as varnish. Other proportions of ingredients are sometimes employed; but in all the resinous juice of the *semecarpus* predominates. The varnish is laid on like paint, and, when dry, is polished by rubbing it with an agate or smooth pebble. This varnish also prevents destruction of wood, &c. by the *white ant*.

DOUGHTY'S RUBY PEN.

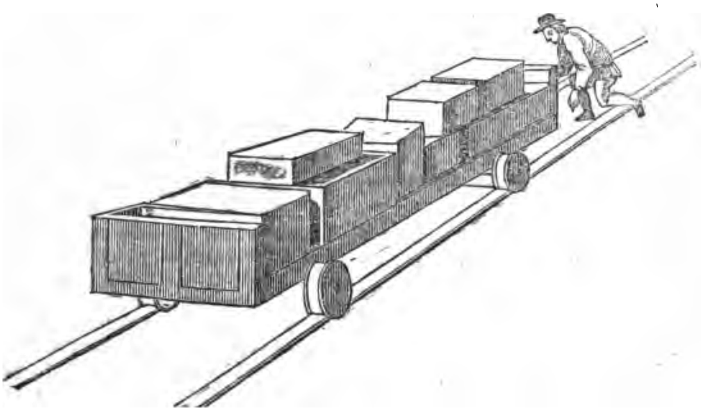
Sir,—In answer to the inquiry of your Correspondent, G. H., page 98, vol. iv. of your valuable miscellany, requesting the address of Mr. Doughty, the inventor and manufacturer of the Ruby Pen, I beg to inform him that it is No. 10, Great Ormond-street, London. By giving this publicity you will oblige,

Yours respectfully,

R. Lewthwaite.

Rotherhithe, May 26, 1825.

RAILWAY WAGGON.



Sir,—The above drawing is of a waggon or carriage which ran on a wooden railway, at Prior Park, near Bath, in the year 1741. The road was a gradual descent of nearly a mile long; to the hinder part of the waggon was a contrivance by which a single man could check the motion, though heavily laden with large blocks of stone, which must have a great tendency to urge it forward.

I am, Sir,
Your obedient servant,
F———.

SOCIETY OF ARTS.

ANNUAL DISTRIBUTION OF REWARDS.

At the Annual Distribution, this week, of the Rewards given by the Society for the Encouragement of Arts, Manufactures, and Commerce, there were fifteen awarded in the branch of mechanics. The following were the most remarkable:—

Mr. W. Hardy, Wood-street, Spafields, obtained the gold medal, for an instrument to ascertain very small intervals of time. The Secretary stated, that this instrument was so excellently constructed, that it would divide a second of time into 300 equal parts. It was used in the first instance at Woolwich, by the artillery officers, in throwing shells and other projectiles, and it had since been introduced at the Royal Observatory at Greenwich. Its functions were performed by pressing a spring, and, of course, the muscular power of different persons would create in the instrument different degrees of motion, so that it was difficult to make an exact estimate of its truth. But all who examined it admitted that it was a very extraordinary piece of mechanism.

Colin Shakespear, Postmaster-General, Calcutta, obtained the gold Vulcan medal, for a portable rope bridge.

This species of bridge, the Secretary observed, might be supported on that species of soil which was found in all the water-courses of India. The whole of the materials might be removed on the backs of bullocks from one place to another, and speedily fastened together with metal hooks and eyes. It was constructed on the principle of the chain bridge, and was extremely well adapted to military purposes in India and other tropical countries, where the water-courses are, in the course of a few hours, swollen to torrents. Three bridges on this plan had been constructed in India. The first was constructed near Calcutta; after it had been removed there for some time,

it was taken down, and carried to the distance of eighty miles on the backs of bullocks. It was then re-constructed, and braved, without deterioration, the storms of the spring.

A more precise account of these bridges, called, after their inventor, "Shakespearian Bridges," will be found at p. 300 of our third volume. The following additional particulars we extract from a recent number of the *Calcutta Gazette*:—

"These (bridges) are, the celebrated Berai torrent-bridge, eighty miles from Calcutta, near Bancoorah, of 160 feet span, by 9 feet 6; the Gooseyturah torrent-bridge, west of Hazareebaugh, 150 clear span, by 9 feet; and that over the Carramnassa River, of 320 feet by 8 feet 9. They are all composed of tarred coir rope, so light as from three to five inches in circumference, and were constructed in Calcutta by the Superintendant-General. That of the Carramnassa, from its magnitude, and the very peculiar circumstances of its situation, appears to have drawn a crowd of spectators from the *Holy City* of Benares and adjacent country, and is hailed as a boon bestowed on all Hindoos and pilgrims, who are now enabled to pass over the polluted waters equally free of contamination and expense. It is, at the same time, universally admitted, that the projector has succeeded in accomplishing a work of much utility, which has hitherto baffled every effort of power and money. We understand farther, that the Shakespearian bridge is in a fair way, under the auspices of Government, of being generally introduced throughout the inner range of the Hymalayah Mountains. It is peculiarly adapted to the River Sutlej, with high precipitous rocky sides, the width not very great, but the roaring of the torrent tremendous; the forests affording all the materials necessary, at inconsiderable expense, and the simplicity of the construction is such, that the mountaineers themselves will soon learn to set them up without European assistance. When we consider the number of lives that are sacrificed every succeeding year in passing mountain torrents, by the frail Joolah, and other inefficient methods hitherto in use, and that neither cattle nor merchandize can pass over them, there is great reason to rejoice in the happy introduction, by means the most simple, of an ingenious scheme, in every way fraught with benefit to mankind."

EGYPTIAN ORE.

Sir,—Observing in your really useful publication an inquiry respecting M'Phail's Egyptian Ore, I beg to offer my individual testimony as to its merits. I consider it as decidedly the most perfect imitation of gold which has yet been discovered. It *will* retain its colour as long as the material itself, and the slightest friction of a soft leather will at all times restore its original lustre. It, of course, will not resist the test of aquafortis; this is a criterion which gold alone can endure; but, in every other respect, I believe it to possess all the properties hitherto deemed as exclusively belonging to that metal. I have a watch and chain of his Egyptian ore, to which are suspended two sterling gold seals; and it is a singular fact, that I have frequently placed them in the hands of jewellers and workers in gold, requesting them to distinguish the real from the imitative metal, *without applying the test*, and in every instance they have been unable to decide.

As it is possible that some of your readers, deeming this a mere anonymous communication, may not attach that credence to my statement which it really deserves, I enclose a few cards of my address,* and shall be happy personally to satisfy any inquirers who may deem it worth their while to favour me with a call; and I have made the above statement solely from an anxiety to offer my testimony to the merits of an invention which, I firmly believe, only requires to be more known to be universally patronized.

I am, Sir, yours, &c.

V.

WOODEN CHURCH CLOCKS.

Sir,—In answer to your Correspondent, Vittoria (p. 91, vol. iv.),

* Which may be had by applying to our publishers.—Edit.

respecting Turret Clocks, I would inform him, that they may be made from 35*l.* upwards, to answer the same purpose as those for 60*l.*, and equal in workmanship. The difference will consist in casting the bell of the same shape as the present house clock bells; less metal will be required, and the clock need not be so large as is necessary for bells cast in the present way for turret clocks.

I am, Sir,
Your constant reader,
J. CRAGG,
Clock-maker, Vauxhall.

INQUIRIES.

NO. 126.—ANNEALING IRON PLATES.

SIR,—As your highly valuable Magazine extends itself to (I hope) at least every manufactory in the United Kingdom, it has, no doubt, before this, found its way into some of our tin-plate works in Wales; and, if so, I should be glad to be informed, through the medium of your columns, what method is practised to anneal the iron plates, and to get off the scales from the face of them, prior to their being tinned, as I apprehend it is absolutely necessary that the plate should present to the tin a perfectly clean surface, free from scale or oxide of any sort.

I am, Sir,
Your constant reader,
* * * * * *

ANSWERS TO INQUIRIES.

NO. 78.—IRISH LIME KILNS.

[EXPLANATION.]

SIR,—In reply to some further inquiries respecting the Irish Lime Kilns, I beg to observe—

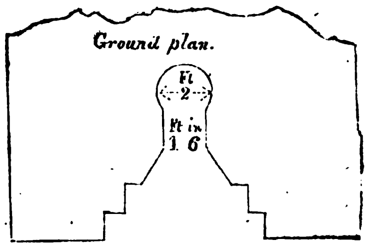
1st. That your Correspondent has not been able to distinguish, on your engraving, the word "sweep," a term usual amongst workmen for the length of the radius of the circle they wish to describe.

2nd. The kiln is filled, two feet high, with turf first, then a layer of limestone of about one foot, then again two feet of turf, and so on, alternately, to the top.

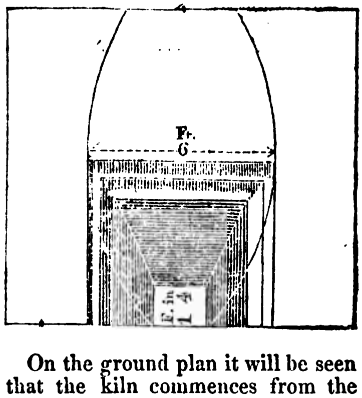
3rd. The kiln is ignited by placing a burning turf at the bottom.

4th. The kiln I gave a sketch of was intended to have thick iron bars to draw up, one by one, as occasion might require, being the most ready means of getting out the lime when burnt; but the kilns are generally made without any bars.

I am sorry, Sir, to trouble you with other figures, but I cannot explain this matter without them.



Elevation.



On the ground plan it will be seen that the kiln commences from the floor, on a circle of two feet diameter, opening, on one side, to a square aperture of one foot six inches, which is covered in at the height of one foot four inches from the floor (see the Elevation). This aperture, or

eye, of the kiln, is then gradually enlarged, for the convenient admission of a workman, who takes out the lime with a shovel.

In Ireland the stone in general stands fire so well, that these kilns are not lined with bricks; but if made with what your Correspondent, S. F., calls limestone-grit, I conceive bricks will be necessary.

I am, Sir,
Your obedient servant,
G— C—.

Brompton, April 30th, 1825.

NO. 121.—COMPARATIVE STRENGTH OF MALT AND SUGAR.

SIR,—In answer to the inquiry of your Correspondent, J. S. M., as to the comparative strength of Malt and Sugar, I beg to state, through your valuable miscellany, that, at their present respective prices, the advantage is greatly in favour of the former, whatever the process to which either may be subjected which has for its object the production of saccharine matter. For example:

	£.	s.	d.
Two hundred pounds of the coarsest sugar, at the lowest price, will cost	5	0	0
One-eighth of which, consisting of watery particles, will be lost	0	12	6
	£5	12	6

	£.	s.	d.
A quarter of the best malt, yielding at least 200 pounds of saccharine matter, liable to no diminution, costs ..	3	10	0
Balance in its favour........	2	2	6
	£5	12	6

Further—A given portion of saccharine matter, the process being properly conducted, will yield a certain quantity of proof spirit; and no more; therefore the extract from malt and sugar are of equal worth, weight for weight, in producing a fermentable subject.

I am, Sir,
Your constant reader,
J—— J——.

Marshall-street, Golden-square.

CORRESPONDENCE.

A "Constant Reader" has deceived himself, in supposing that he has discovered a method of trisecting an angle geometrically;—he does not seem to have been aware, that to trisect a *straight line* has never been a matter of difficulty —and this is all he has effected. When, in future, he conceives he has made a discovery in geometry, it would be well if he would attempt a demonstration of it; had he done so in the present instance, he would have found out his error.

Amicus's paper will be commenced in our next.

Cæsar Borgia is requested to send to our publishers for a letter addressed to him.

Communications received from—D. C. —A Constant Reader—J. Jay—M. P.— D. Z.—Shero—E. P. Jun.—G. B. K.— Gulielmus—M. N.—Three Joiners— Philo-Mechanicus—P. D.—A Diamond Cutter—Peter Butler—Dr. Claridge— An Old Friend—Axle—O. E.—Spur-wheel—A Reader at Finchley.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by MILLS, JOWETT, and MILLS (late BENSLEY), Bolt-court, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 94.] SATURDAY, JUNE 11, 1825. [Price 3d.

"Isthinc est sapere, non quod ante pedes modo est
"Videre, sed etiam illa quæ futura sunt prospicere." *Terence.*

"True wisdom consists not in seeing that which is before our eyes, but in the foresight of that which is to happen."

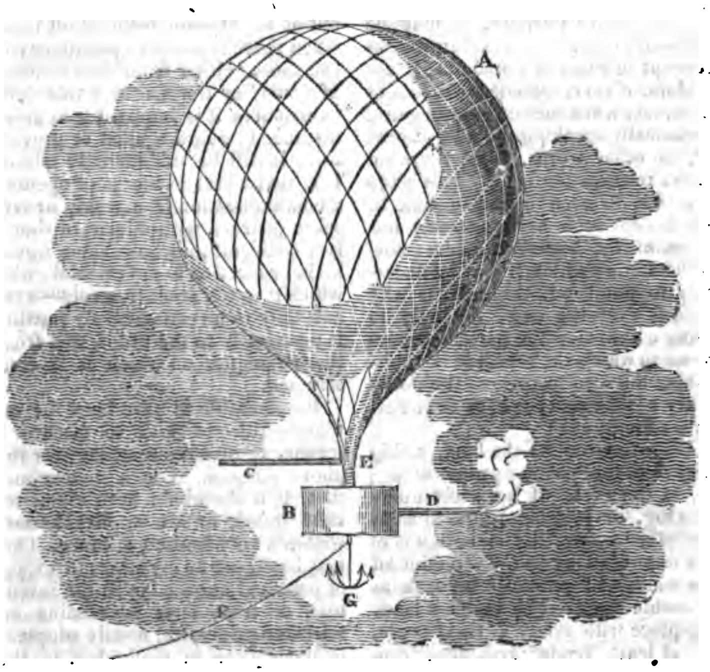
MACHINE

FOR THE

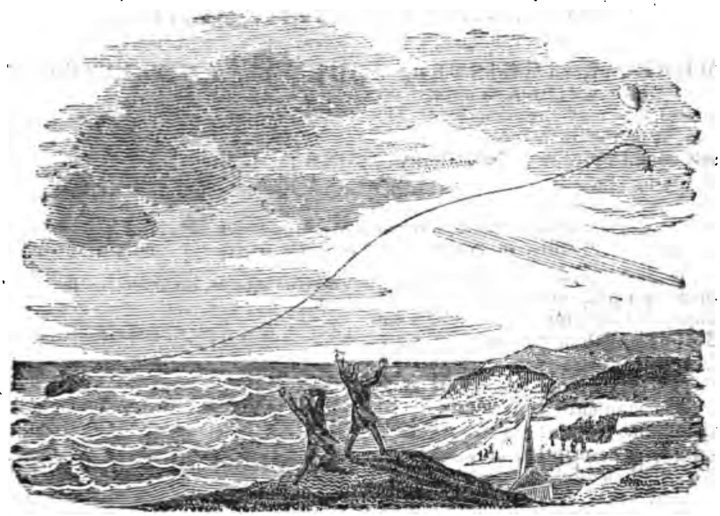
PRESERVATION OF PERSONS IN DANGER OF SHIPWRECK,

PARTICULARLY ON A LEE-SHORE.

INVENTED BY FRANCIS HIGGINSON.



MR. HIGGINSON'S MACHINE FOR THE PRESERVATION OF PERSONS IN DANGER OF SHIPWRECK.



Sir,—Previous to entering into a description of the machine invented for the above purpose, it may be necessary to premise, that shipwrecks (except in cases of foundering), are seldom, if ever, attended with loss of lives, save when such calamity occurs, technically speaking, on a lee-shore; or, in other words, when the wind blows towards the land. This is too manifest to need demonstration to any except such as are utterly unacquainted with nautical affairs: notwithstanding which, it may be necessary to point out the reasons why such is ever the case, not only to bring within view the particular purposes to which the machine is applicable, but also to prevent the possibility of misconception, or the existence of a doubt.

With the wind off the land, a ship may at all times keep a proper offing; or, in the event of her accidentally striking, or being endangered from any other cause, the smoothness of the water, owing to the direction of the wind, will generally be such as to enable the crew to reach a landing-place with safety in their boats, or, at least, render assistance from the shore not wholly impracticable. This being the case in nineteen cases out of twenty—in fact, at all times when there is no local peculiarity in the shore, either from the existence of a surf, or the set of a tide (circumstances it is impossible in every instance to guard against or provide for), it will be undoubtedly admitted, that a certain means of opening a communication from a ship or vessel in distress, with a leeward shore, is a desideratum whose value would be in proportion to the certainty with which it would at all times act—a result only to be estimated by putting it practically to the proof, and from the principles on which it is constructed.

Innumerable as have been the attempts hitherto made to discover a means, or invent a machine, for the above purpose, it is a melancholy fact, that the whole have either totally failed, or are applicable only within a very limited distance. This may have been owing either to a want of practical knowledge in the inventors, or from their proceeding on mistaken principles, hastily adopted, or inadequate in themselves to the

purposes for which they were intended. To particularise the experiment recently tried, of throwing an anchor on shore by means of a gun, might appear invidious, were it not selected (as it really is) on account of its excellence, within any distance its capabilities command, which, however, from its nature, are necessarily very circumscribed. The weight of the anchor or grapnel itself would prevent the possibility of its flying far, were the resistance made by the chain or rope attached to it, and its shape, peculiarly unadapted for dividing the air, left entirely out of the question. This, then, is a principle on which it were hopeless to attempt succeeding; and floating any thing towards the shore, has been proved from experience as too uncertain a means to need or deserve a moment's consideration. All, then, that remains, is to proceed at once to a description of a machine, which, depending for success on a natural cause (the lightness of hydrogen gas, as compared to atmospheric air), can scarcely, it is estimated, fail; at the same time establishing the utility of an art (I allude to aërostation), which, although acknowledged wonderful, has been always heretofore described as useless.

I am, Sir,

Your obedient servant,

F. Higginson.

Machine.

This invention consists, in the first place, of a silk bag, air tight; in fact, a common balloon, capable of containing, at the most, 2000 feet of hydrogen gas, and, consequently, of raising a weight of sixty pounds averdupois. This, when not inflated, may be compressed within a very small compass; but to guard against any possible flaw or injury existing either in the material, or arising from accident, every ship or vessel ought to be supplied with three distinct bags or balloons. Before I proceed to a description of the other parts of the machine, it may be necessary to observe, that hydrogen gas, for inflating the above-mentioned balloon, may at any time be produced by an union of zinc, water, and sulphuric acid. The sulphuric acid, together with the zinc, might be packed in the case containing the machine; a barrel or cask of water being then all that would be required for the purposes of inflation. Printed instructions, in language it were impossible to misunderstand, would, of course, accompany the case containing the machine, pointing out the exact proportions to be used in mixing the ingredients for producing the gas, together with the method of doing so; which, in fact, amounts to nothing more than immersing the zinc in the water, and afterwards adding the sulphuric acid.

To prevent either trouble or delay in affixing the balloon to the cask of water for inflation, a brazen tube, two inches deep, having a strong sharp screw cut on the outside of it, will be, when manufactured, affixed to the neck of every balloon. Through this pipe or neck, which will be in diameter the same as the common bunghole of a cask, the balloon will, of course, be inflated. The ingredients for producing the gas having been mixed, the balloon is to be attached to the cask containing them, by screwing the brazen neck or pipe into the bung-hole—a key, on the principle of a lever, for doing which, with facility, will accompany the machine. It is to be observed, that a little white lead ought to be laid round the screw, previous to inserting it into the bung-hole, in order to prevent any of the gas from escaping through the insterlices existing between the wood and the screw.

A strong wooden box, or magazine, capable of containing four pounds of gunpowder, with a common fuse or portfire inserted into it, the length of which (the fuse) will depend on the distance the vessel is from the land, constitute the remaining portion of this invention. The fuse inserted into the magazine, being on the same principle as that used for exploding a shell, will, however, be left sufficiently long, when originally supplied, to answer any distance, but may be cut shorter, should the danger be imminent, and the land very near; although it would be better at all times to leave sufficient length to permit the balloon to get well over the land before the magazine explodes. The inflation of the balloon being completed, which will of course be known by the expansion of the bag, a nipper, or piece of cord, is to be passed tightly round the neck of the bag, above the brazen ring or screw, in order to prevent the gas escaping, and the machine disengaged from the cask, by unscrewing it from the bung-hole with the key or lever. Previous to doing so, the balloon must, of course, be secured to a belaying-pin by a strong rope, to prevent its rising, until the remainder of the apparatus is affixed. The magazine or box is then to be fastened to the balloon, by inserting the screw at the neck, into a socket fitted to receive it, attached to the upper part of the box.

This having been done, and a small grapnel, with a rope attached, hung to the bottom of the magazine or box, by an eyebolt fixed there for the purpose, the fuse is to be set on fire, and the machine liberated. The direction of the wind, as before observed, on a lee-shore, will always drive it towards the land; the distance from which will, of course, regulate the size of the rope that should be applied to the grapnel, being smaller in proportion to the length it has to go. It is scarcely necessary to observe, that if sufficient rope is supplied, the balloon cannot fail in conveying the grapnel over the land; or that, when the fire of the fuse reaches the powder, it will explode, and thereby detach the grapnel and rope from it. This, however, is not the only purpose the fuse is intended to answer; as, should the calamity occur at night, the light, whilst in the air, together with the explosion, will direct the inhabitants on the beach to the place where the grapnel will fall. The advantages of a communication thus opened with the land, it is needless to dwell upon; personal experience having shown me, could such have been effected, a number of valuable lives might have been saved. Should, however, even one unfortunate be rescued in the hour of his distress, the knowledge would constitute in itself more than a reward for the anxiety and trouble the perfecting this machine has entailed on the inventor.

Description of the Engravings.

Fig. 1. A, the balloon, capable of containing 2000 feet of hydrogen gas, and raising a weight of sixty pounds, attached by the neck-screw to the box or magazine.

B, the magazine, containing four pounds of powder.

C, a keg or lever detached, when the box is screwed on.

D, the fuse, or port-fire.

E, neck-screws.

F, the rope communicating with the ship.

G, a grapnel hung from the eye-bolt.

Fig. 2 represents the scene of a shipwreck on a lee-shore, and the instrument in operation.

ELECTRIC TELEGRAPHS.

Sir,—There is, I think, in one of the numbers of the Spectator, dated about a hundred years ago, a passage tending to ridicule some projector of that day, who had proposed to "turn smoke into light, and light into glory." This early idea of gas-light, to which it seems plainly to refer, was received as an idle dream, and is only preserved to us, like straws in amber, by the wit and satire of Addison or Steele. We are to learn, therefore, not too hastily to reject even those hints which are not immediately clear to us.

Under protection of this remark, I venture to propose to you, that a telegraphic communication may be held, at whatever distance, without a moment's loss of time in transmission, and equally applicable by day or night, by means of the electric shock.

An experiment of this kind has been tried on a chain of conductors of three miles in extent, and the shock returned without any perceptible time spent in its going round; and may not the same principle be applicable for 100 or 10,000 miles? Let the conductors be laid down under the centre of the post-roads, imbedded in rosin, or any other, the best nonconductor, in pipes of stoneware. The electric shock may be so disposed as to ignite gunpowder; but if this is not sufficient to rouse up a drowsy officer on the night-watch, let the first shock pass through his elbows, then he will be quite awake to attend to the second; and by a series of gradations in the strength and number of shocks, and the interval between each, every variety of signal may be made quite intelligible, without exposure to the public eye, as in the usual telegraph, and without any obstruction from darkness, fogs, &c. It was mentioned before, that electricity will fire gunpowder—that is known; we may imagine, therefore, that on any worthy occasion, preparations having been made for the expected event, as the birth of a royal heir, a monarch might at one moment, with his own hand, discharge the guns of all the batteries of the land in which he reigns, and receive the congratulations of a whole people by the like return.

I am, Sir,
Very respectfully yours,
Moderator.

INFLUENCE OF COPPER, ETC. ON MAGNETIC NEEDLES.

M. Arago lately communicated to the Academy of Sciences some interesting experiments relative to the oscillations of a magnetic needle, surrounded by different substances. He had ascertained that the copper rings, with which dipping needles are generally surrounded, exerted on the needles a very singular action, the effect of which was rapidly to diminish the amplitude of the oscillations without sensibly altering their duration; thus, when a horizontal needle, suspended in a ring of wood by a thread, without tension, was moved 45° from its natural position, and left to itself, it made 145 oscillations before the amplitude was reduced to 10°. In a ring of copper the amplitude diminished so rapidly that the same needle moved 45° from its natural position, and only oscillated 33 times before the arc was reduced to 10°. In another ring of copper, of less weight, the number of oscillations between the arcs of 45° and 10° were 66. The time of the oscillations appeared to be the same in all the rings.

In the ring of wood, 145 oscillations, 45 deg. to 10 deg.

In the ring of copper, 33 oscillations, 45 deg. to 10 deg.

In a lighter ring, 66 oscillations, 45 deg. to 10 deg.

SHORT METHOD OF CALCULATING PROFIT AND DISCOUNT.

SIR,—Agreeing with the motto of a late Number of your publication, that "*Trade is the Golden Girdle of the Globe,*" I beg to offer "something to the general use," upon a subject that deeply concerns every one connected with trade.

As "M. W.," in his own defence, has ably exposed the "gross blunders" of your Birmingham Correspondent, I need not address a word to him or the "very large manufacturing district" that (as he says) adopts the same false principles for their "constant practice;" but I would beg to submit, through the medium of your valuable miscellany, a short Table, which I formed some years ago for my own use, and which, I think, will be found to be according to "Cocker," and upon the universally received and correct principles of our best commercial writers—*e. g.* Evans's Tables of Profit and Discount, a 4to. volume, the *seventh edition* of which has recently appeared, price *only* one guinea. Now, as I believe that each item of this expensive work may, by the aid of the subjoined method, be as correctly and very expeditiously obtained, I need not make any other apology for troubling you. Should this be deemed worthy insertion, I shall feel a pleasure in appearing again upon your pages, in further elucidation of this and other commercial calculations.

I am, Sir,

Yours respectfully,

W—— L——.

Windsor-street, Islington,
May 15, 1825.

A TABLE,

Exhibiting to immediate view the additional rate per cent. required to sustain the reaction of a given discount, without affecting the principal; also, showing the gain or profit upon goods purchased under a discount, and resold at the gross price.

Rate per Cent.	Profit or Discount. £.	s.	d.
2½	2	11	3¾
5	5	5	3¼
7½	8	2	2
10	11	2	2¾
12½	14	5	9¼
15	17	15	6½
17½	21	4	3
20	25	0	0
22½	29	0	7¾
25	33	6	8
27½	37	18	7¼
30	42	17	6
32½	48	2	11½
35	53	16	11
37½	60	0	0
40	66	13	4
42½	73	18	3½
45	81	16	4¼
47½	90	9	5¼
50	100	0	0

Example.—To be able to allow 20 per cent. it is required to put on 25 per cent. for 25 + 100 = 125 − 20 per cent. (or $\frac{1}{5}$) = 100; and goods bought at 20 per cent. discount off, clears 25 per cent. profit; for 100 − 20 = 80, nett cost, and 80 + $\frac{1}{4}$ (or 25 per cent.) = 100.

To obtain the results in the preceding Table, divide the given sum by the decimal opposite to the rate per cent., or multiply by denominator, and divide by the numerator, of the vulgar fraction.

Rate per Cent.	Dec.	V. F.
$2\frac{1}{2}$	,975	$\frac{39}{40}$
5	,95	$\frac{19}{20}$
$7\frac{1}{2}$	,925	$\frac{37}{40}$
10	,9	$\frac{9}{10}$
$12\frac{1}{2}$	,875	$\frac{7}{8}$
15	,85	$\frac{17}{20}$
$17\frac{1}{2}$	,825	$\frac{33}{40}$
20	,8	$\frac{4}{5}$
$22\frac{1}{2}$	,775	$\frac{31}{40}$
25	,75	$\frac{3}{4}$
$27\frac{1}{2}$	,725	$\frac{29}{40}$
30	,7	$\frac{7}{10}$
$32\frac{1}{2}$	,675	$\frac{27}{40}$
35	,65	$\frac{13}{20}$
$37\frac{1}{2}$	,625	$\frac{5}{8}$
40	,6	$\frac{3}{5}$
$42\frac{1}{2}$	,575	$\frac{23}{40}$
45	,55	$\frac{11}{20}$
$47\frac{1}{2}$	,525	$\frac{21}{40}$
50	,5	$\frac{1}{2}$

Example.—For 20 per cent. 100 ÷ 8 = 25; or, 100 × 5 = 100 + 4 = 25.

As almost every person understands the rates by aliquot parts, it would be needless to add a Table thereof.

ILLUSTRATIONS.

A manufacturer's prime cost of goods being 100*l.* what should he charge for them to clear 20 per cent. profit, and (according to the custom in his branch of trade) allow a discount of 30 per cent.?

100 + 20 per cent. (or $\frac{1}{5}$) = 120 ÷ ,7 = 171*l.* 8*s.* 6$\frac{3}{4}$*d.*

171*l.* 8*s.* 6$\frac{3}{4}$*d.* − 30 per cent. (or $\frac{3}{10}$) = 120.

Suppose expenses of carriage, &c. increase the price of the said goods to the wholesale dealer 2$\frac{1}{2}$ per cent. how much would he gain if he sold them at the gross price?

120 + 2$\frac{1}{2}$ per cent. (or $\frac{1}{40}$) = 123 − 171*l.* 8*s.* 6$\frac{3}{4}$*d.* = 48*l.* 8*s.* 6$\frac{3}{4}$*d.*, being a gain of above 10 per cent. more than the discount he was allowed.

Suppose, again, that the person he sells them to should (from certain circumstances) be inclined to dispose of them at a loss of 30 per cent. what should they produce, by public sale, to clear broker's commission, auction duty, &c. amounting to 12$\frac{1}{2}$ per cent.?

171*l.* 8*s.* 6$\frac{3}{4}$*d.* − 30 per-cent. (or $\frac{3}{10}$) = 120 ÷ ,14 = 142*l.* 17*s.* 1$\frac{3}{4}$*d.*

142*l.* 17*s.* 1$\frac{3}{4}$*d.* − 12$\frac{1}{2}$ per cent. (or $\frac{1}{8}$) = 120.

And, again,—Suppose (a common case) a manufacturer produces a new article, which he sells at a profit of 40 per cent. but, competitors starting, he is compelled to lower his price; and, from time to time, as opposition increases, he comes down until he offers the article at 30 per cent. under his original charge, he will (it is very probable) tell you that he is still gaining 10 per cent., but, in fact, he is losing —he is selling at 98*l.* what cost him 100*l.*

A HINT TO MECHANICS' INSTITUTIONS.

At the end of one of the gratuitous lectures which Dr. Gregory has lately been delivering to the Mechanics' Institution at Crayford, he suggested to them a plan by which they might become their own lecturers, which was this:—Select some instructive popular work, as Ferguson's Select Lectures, Millington's Lectures, the second volume of Gregory's Mechanics, Bonnycastle's or Brinkley's Astronomy, Tilloch's Mechanics' Oracle, the London and Glasgow Mechanics' Magazines: let these, or appropriate portions of them, selected by the Committee, be read in order, and made the subject of conversation at alternate meetings. To render the subjects equally plain to readers and auditors, let three or four boards be provided, each presenting a face of about four feet by three, and let them be painted black. Let some member or members of

the Committee draw such figures and diagrams of reference, *with chalk*, on a large scale, upon one or more of these boards, as may be required for the evening's reading. These boards, placed in suitable positions, and with a good light thrown upon them, will render the respective subjects as intelligible to the auditors as to the individual who reads, and thus remove the great obstruction to the communication of knowledge, where diagrams are concerned, to a large auditory by a single reader. Moulds of circles, ellipses, squares, parallelograms, &c. along the contours of which chalk may be drawn, will much shorten the labour of sketching the diagrams.

AN ESSAY

ON THE

QUADRATURE OF THE CIRCLE.

[TO THE EDITOR OF THE MECHANICS' MAGAZINE.]

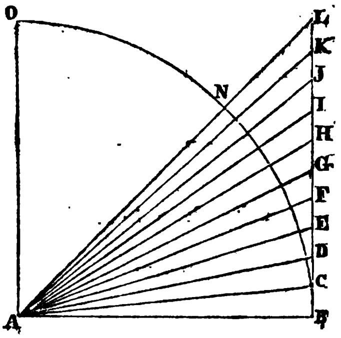
SIR,—Although the celebrated problem of finding the quadrature, or the ratio, which the periphery bears to the diameter of the circle, has passed through the hands of many eminent mathematicians since its solution was first attempted by Apollonius Pergæus, and afterwards by Archimedes of Syracuse, the greatest geometricians of antiquity, it is still susceptible of various novel solutions, quite different from those previously given to it by any of the famous authors who have treated on the subject; and as I conceive *the grand object* of the *Mechanics' Magazine* is to give publicity to new improvements in the Arts and Sciences—I will, with the Editor's permission, present its readers with one of these new methods of solution, intending to publish the whole myself in a separate pamplet at some future period. This solution assigns the length of a given circular arc in an elegant and novel series, which is afterwards *summed* or converted into another series, for the purpose of numerical computation. Subsequently a new and general theorem is investigated, and applied to finding various serieses of very rapid convergency; among these are deduced, from our theorem, the best of those given by the celebrated authors, Euler, Machin, Hutton, and Bonnycastle. From the same source is also derived a new and quickly converging series in terms of the arc of 45°, and consequently its root is the eighth part of the whole circumference of the circle. The same fertile theorem enables us to divide the whole periphery into 8 N equal parts, and having just glanced at the method of doing this, I shall conclude the Essay, not, however (I hope), without exciting some interest among the geometrical readers of your valuable miscellany, should you, Mr. Editor, deem it worthy of insertion.

I am, Sir, yours sincerely,

Horton-lane, Bradford, Yorkshire. AMICUS.

PROPOSITION I.—PROBLEM.

INVESTIGATION AND SUMMATION OF A NEW SERIES, EXPRESSING THE LENGTH OF A CIRCULAR ARC.



Let BL, the tangent of the circular arc BN, be divided into n equal parts at the points C, D, E, F, &c., the radius AB being unity; then, assuming the whole tangent BL equal $\frac{1}{t}$, each of the parts, BC, CD, DE, EF, &c. will be equal $\frac{1}{n\,t}$, the tangent of the angle BAC. Now, by means of the well-known trigonometrical formula, $\tan.(a-b) = \frac{\tan. a - \tan. b}{1+\tan. a \tan. b}$, we readily deduce

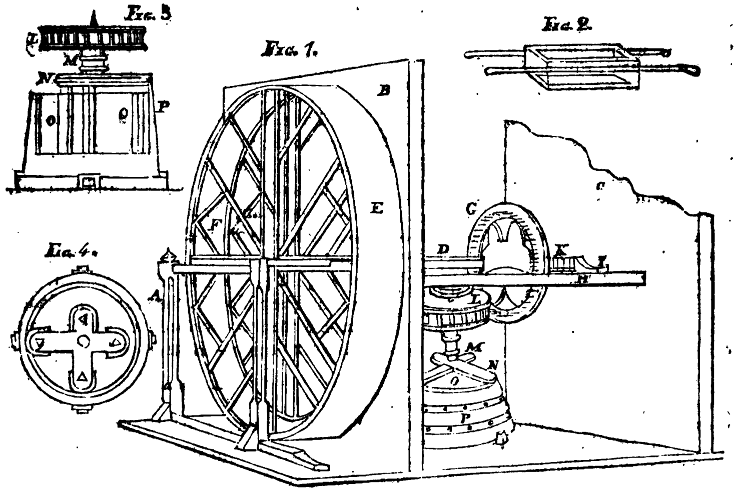
$\tan. \angle \text{CAD} = \dfrac{\frac{2}{n\,t} - \frac{1}{n\,t}}{1+\frac{2}{n^2 t^2}} = \dfrac{n\,t}{n^2 t^2+2}$; $\tan. \angle \text{DAE} = \dfrac{\frac{3}{n\,t} - \frac{2}{n\,t}}{1+\frac{6}{n^2 t^2}} = \dfrac{n\,t}{n^2 t^2+6}$;

$\tan. \angle \text{EAF} = \dfrac{\frac{4}{n\,t} - \frac{3}{n\,t}}{1+\frac{12}{n^2 t^2}} = \dfrac{n\,t}{n^2 t^2+12}$, &c. Where the law of the continuation is obvious, the general expression for the nth tangent being $\dfrac{n\,t}{n^2 t^2 + n(n+1)}$, in which n represents any integer whatever, finite or infinite. If we suppose n to be indefinitely great, then the equal parts into which the given tangent BL is divided, and likewise the angles BAC, CAD, DAE, &c. become indefinitely small. But the tangents and the arcs of such indefinitely small angles being ultimately equal to one another, it thus appears that the length of the arc BN is equal to, or expressed by, the sum of the series $\frac{1}{n\,t} + n\,t\left(\frac{1}{n^2 t^2+2} + \frac{1}{n^2 t^2+6} + \frac{1}{n^2 t^2+12} + \frac{1}{n^2 t^2+20} + \frac{1}{n^2 t^2+30}, + \text{\&c. } in\right.$ $\left. infinitum\right)$; or, since each term of this series is, *bona fide*, a mere point, we are permitted to reject the first term, $\frac{1}{n\,t}$, as being indefinitely small, which will rather simplify the series for the purpose of summation. Thus the rectification of an arc of the circle, on which the quadrature depends, is reduced to

finding the sum of the infinite series $n\,t.\left(\frac{1}{n^2 t^2+2}+\frac{1}{n^2 t^2+6}+\frac{1}{n^2 t^2+12}+\frac{1}{n^2 t^2+20}+\frac{1}{n^2 t^2+30}+\frac{1}{n^2 t^2+42}+\&c.\right)$ (1). I have not, however, been fortunate enough to assign the sum of this elegant series in finite terms, though its simplicity is such as to hold out the hope, that this "consummation, most devoutly to be wished," may, perhaps, be accomplished by abler hands at some future period.

(To be continued in our next.)

KNEADING MILL.



SIR,—Seeing in your Magazine an inquiry by A. B. C. (p. 54, vol. III.), for a Machine for Kneading Dough, I beg leave to inform him, that in the public baking-houses of Genoa, bread has been long manufactured in this manner, with a great saving both of time and labour. I will, with your leave, attempt a description of the machine.

I remain, Sir,
Yours most respectfully,
G—— J——.

Description.

Fig. 1. A is a frame of wood which supports the axis of the machine; a wall, 14 palms high from the ground, may be made use of instead of this frame. B, a wall, 3½ palms thick, through which the aforesaid axis passes. C, another wall similar to the former, and facing it, to the distance of 21 palms. D, the axis, 30 palms in length, and one palm and one-third in thickness. E, the great wheel fixed to the said axis, between the frame and the wall; its diameter is 28 palms, and its breadth, which is capable of holding two men occasionally, is five palms. F are steps, by treading on which the men turn the wheel very smartly; they are two palms distant from each other, and one-third of a palm in height. G, a small wheel, with cogs fixed almost at the further extremity of the axis; its diameter is 12½ palms. H, a beam of wood, which extends from one wall to the other, being 21 palms in length, and one and a third in thickness. A similar beam, not seen in the figure, is on the opposite side of the axis. I, a transverse piece of wood, placed near the wall, C; it is fixed into the two beams, and serves to support the further extremity of the axis; its length is 14 palms, and its thickness one and a third; there is likewise a transverse

piece (which cannot be seen in the figure), 14 palms long, and half a palm thick, placed close to the wall, B. K is a strong curved piece of oak, fixed transversely in the side beams, H, to receive the axis of the trundle; its length 14 palms, and its thickness 1½. Z is a trundle of 5½ palms in diameter, and 1¼ in height, which is moved by the cog-wheel, G. M is a trundle, proceeding from the trundle, L, and continued through the cross, N, to the bottom of the tub, P; its centre is made of iron, partly square and partly round, and it turns in a socket of brass. The first part of this axis, between the trundle, L, and the cross, N, is of square iron, surrounded by two pieces held together by iron hoops, which may be removed at pleasure to examine the iron within; its length is three palms, its diameter about one palm. The second part of the axis, which is within the tube, is made like the first part; its length is a palm and a half, its breadth 1 1-6th palms. The wooden sheath of this part of the axis is fixed to the bottom of the tub by means of three screws with nuts. This axis is distant one-third of a palm from the nearest triangular *beater* of the cross. N, the cross, formed of two bars of wood unequally divided, so that the four arms of the cross are of different lengths; one of the two pieces of wood of which the cross is made is six palms in length, the other five; their thickness is 7-12ths of a palm, and their breadth one palm. O, four pieces of wood, called *beaters*, of a triangular shape, fixed vertically into the extremities of, and underneath the arms of the forementioned cross; they are one and three-quarters palms in length, and half a palm in thickness, and beat or knead the dough in the tub at equal distances from the centre. P is a stout wooden tub, about a quarter of a palm thick, well hooped with iron; its diameter is six palms, its height 1½ in the clear.

Fig. 2 is a box or trough of wood, four palms long, and three wide, in which the leaven is formed (in about an hour) in a stove, and in which it is afterwards carried to the tub, P.

Fig. 3 exhibits a view of the trundle, cross, &c. with a section of the tub.

Fig. 4 is a bird's-eye view of the cross and tub, with the upper ends of the triangular beater. This tub, P, will contain about 18 rubbi (about 19 bushels) of flour, which is carried to it in barrels; the leaven is then carried to it in the box or trough, and when the whole is tempered with a proper quantity of warm water, the men work in the wheel till the dough is completely and properly kneaded. In general, a quarter of an hour is sufficient to make very good dough; but an experienced baker, who superintends, determines that the operation shall be continued a few minutes more or less, according to circumstances.

The measures in the preceding description are given in Genoese palms, each of which very nearly equals 9.85 of our inches. The machinery may be varied in its construction according to circumstances, and the energy of the first mover much better applied than by men walking in a common wheel.

[In November, 1811, a patent was granted to Mr. Joseph Baker, navy-contractor, for a method of kneading dough by means of machinery, which is thus described:—An upright shaft, turning on a pivot, is fixed in the centre of a circular trough, so that the dough placed in such trough may be kneaded by a stone or iron roller on its edge, which passes over it in a rotatory motion, being fixed at a due distance by an horizontal bar or axle to the shaft, which is to be turned by means of one or more horizontal bars also fixed thereto, and worked, like a capstan, by a proportionate number of bipeds or quadrupeds. These horizontal bars have small shares fixed to them, so as to run in the trough, and acting like a plough, they cause the dough to present fresh surfaces for each successive revolution.—Edit.]

WARM BATHING.

Sir—Should Warm Baths be established contiguous to any of the great gas-works, upon the principle recommended by Mr. Bell, in your 92d Number, I would beg leave to inquire of your medical readers how far it may be made to imitate, in efficacy, the saline springs, or sea water, as a bath, by the addition of common salt (muriate of soda); and if so, what proportion of salt should be added to the water for that purpose. I would also wish to inquire; if it could be improved by the addition of any other substance? It would also be desirable to be informed, to what degree of temperature the bath should be heated for general use.

There appear some obstacles in the way to the general adoption of warm baths upon Mr. Bell's principle, which may prevent their becoming "*co-extensive with gas illu-*"

mination," as he rather sanguinely expresses it. To mention one of these, is it likely to obtain, *in every situation* where gas-works are established, a sufficient supply of water, of that degree of purity which is necessary for the purpose of filling the baths? Still, however, I thank him for the hint, and hope the Mechanics' Magazine will be the means of informing that important part of the community (the labouring classes) how they may derive that advantage from tepid bathing *at home*, and at an expense within their means, which has hitherto been enjoyed, at established watering-places, almost exclusively by the fashionable and opulent.

I am, Sir,

Your humble servant,

B——.

Tipton, June 6th, 1825.

CABINET-MAKER'S GUIDE.

New Edition, 95 *pp.* 16*mo. price* 1*s.* 6*d.*

Every Carpenter is acquainted with a little work under this title, which has been published for some years, and held deservedly in considerable estimation. It must be admitted, however, that it was open to much improvement, particularly in the practical application of the rules and cautions necessary to be observed by the workman to ensure success in his operations, and that it left many subjects connected with the general plan wholly untouched. In the present edition these deficiencies have been very ably supplied, by a hand evidently well and practically acquainted with the art of cabinet-making in all its branches. It not only embodies all that was useful in the original Cabinet-Maker's Guide, and adapts to practice the rules there contained, but contains a great deal of new matter of the most valuable description. We would particularly instance the additions under the head of Varnishing, French Polishing, Gilding, and Buhl Work; as also an Appendix of very useful Tables, which show, by inspection, the superficial content of any board or plank, without having recourse to duodecimals, or cross multiplication. Altogether the work leaves little to be desired; and being as cheap as it is complete, ought to be in the hands of every cabinet-maker, chair-maker, japanner, gilder, and lackerer. We shall quote, as a specimen of the original matter it contains, the following useful directions to workmen, with respect to the choice and management of their tools:—

"With respect to choosing the tools used in the trades to which I have alluded, the most necessary, and in which all may be comprehended, are planes, saws, and chisels; and we will consider them with respect to the wood they are manufactured from, and the steel which form the cutting part of them. And, first, beech is in general, and ought to be *always* used, for the purpose of the stocks, handles, &c., as it is of a tough texture, and not liable to split or warp so much as any other. Now there are two kinds of beech, usually known by the names of black or red beech, and the white beech; the former is by far the best in every respect, and may be always known by its colour and texture, which is darker and more hard in substance; the white is also more apt to warp, and soon wears with use; it should therefore always be rejected as improper. Again, if you examine a piece of beech endways, you will perceive the grain run in streaks, which, among workmen, is called the *beat* of the wood; and in all planes this grain or beat, which is the hard fibrous particles of the wood, should run in a direction perpendicular to the face of the plane, which in that case appears full of little hard specks; whereas, if the beat runs parallel to the face, it will appear in irregular streaks, which situation of the grain should always be avoided, as the face will be apt to wear uneven, and more subject to warp and twist. Again, in saw-handles and stocks for bits, the beat should run in the same direction as the saw-blade, or in the same direction as the stock, when laid on its side. In moulding-planes it is very frequently the case, that pieces of box are let into

that part of the face that forms the quirk of the mouldings; but that, when possible, should be avoided, as the texture of the two woods are very different, and the different temperature of the atmosphere will cause a difference in their contraction, and consequently the plane will be liable to cast. If it is at any time introduced, I would recommend only a small piece just at the mouth of the plane, firmly dovetailed in, which will not be so apt to derange the accuracy of the plane.

"With respect to saws, chisels, and other edge-tools, their goodness depends upon the quality of the steel, which should be uniform throughout, and it is always better to have them tempered rather too hard than soft, for use will reduce the temperature: or if at any time it is necessary to perform the operation yourself, the best method I can recommend, is to melt a sufficient quantity of lead to immerse the cutting part of the tool. Having previously brightened its surface, plunge it into the melted lead for a few minutes, till it gets sufficiently hot to melt a candle, with which rub its surface, then plunge it in again, and keep it there till the steel assumes a straw colour (but be careful not to let it turn blue); when that is the case, take it out, rub it again with the tallow, and let it cool; if it should be too soft, wipe the grease off, and repeat the process without the tallow, and when it is sufficiently hot, plunge it into cold spring water, or water and vinegar mixed. By a proper attention to these directions, and a little practice, every workman will have it in his power to give a proper temper to the tools he may use. If a saw is too hard, it may be tempered by the same means; but as it would be not only expensive, but, in many cases, impossible to do it at home, a plumber's shop is mostly at hand, where you may repeat the process when they are melting a pot of lead. But here observe, that the temper necessary is different to other cutting tools; you must wait till the steel just begins to turn blue, which is a temper that will give it more elasticity, and, at the same time, sufficient hardness.

"With respect to choosing your brushes for varnishing, it is necessary that they possess elasticity combined with softness, and that the hairs are sufficiently mixed, so that taking hold of one hair, it will not pull out or separate from the rest. The larger brushes are usually made of bristles, the smaller of camel's hair; the former must be firmly tied to the handle, and the string well glued. The latter are best put into a tin-case, and after being used must always be cleaned according to the directions given in the course of this work.

"By paying proper attention to these directions, and a little care, the workman will be enabled to keep his tools in order, and to select such as are proper for the purpose they are intended."

EFFECT OF SCIENTIFIC READING.

Sir,—Although there is now such a general strike for an advance in wages among workmen of almost every trade, I feel the greatest pleasure and satisfaction in giving you the gratifying intelligence, that not one of my men who is in the habit of taking your valuable little work, is among the disorderly. On the contrary, they endeavour, by whatever means lie in their power, to prevail upon their fellow-men to return to their duty. I confess, that at one time I had a strong prejudice against the mechanics attending to such a thing as science; how my views of the case are altered, I need not tell you; I can only say, you may now reckon me as one of your greatest admirers and constant readers.

From yours, truly,

A Master.

May 31st, 1825.

[We are gratified by this testimony to the beneficial effect of our labours, but hope it will not hence be inferred, that we concur in the opinion which the words of our Correspondent seem calculated to convey, that *all strikes* for advances of wages are necessarily "*disorderly*," and a breach of "*duty*." We can conceive cases in which workmen have no other means left of obtaining justice; but, to be fully justifiable, they must, of course, be unaccompanied by violence or intimidation.—Edit.]

THE LOG-LINE.

SIR—The method commonly made use of for measuring a ship's way at sea, or how far she runs in a given space of time, is by the log-line and half-minute glass. It is clear to me, that a machine might be constructed with a dial-plate, similar to that of a perambulator, which might be divided agreeably to the rules of navigation. If such a machine has ever been made use of, any Correspondent will oblige me by giving a description of it in the Mechanics' Magazine.

I am, Sir,

Yours respectfully,

M—— M——.

THE USE OF THE SLIDING RULE.

(*Continued from page* 132.)

PROBLEM I.

To multiply numbers together.

RULE.

Place unity or 1 on the upper line of the *slide*, marked B, to the multiplier on the line marked A on the *rule;* then against the multiplicand on B is the product, as A.

EXAMPLE I.

Let it be required to multiply 48 by 76.

Set 1 on the line B to 76 on the line A, then against 48 on the line B will be the number 3648 on the line A, which is the answer required.

EXAMPLE II.

Multiply 498 by 82.

Set 1 on the line B to 498 on the line A, then against 82 on the line B stands 40,836, the answer.

NOTE.

It may be here asked, How, in the First Example, I find the number 3648 opposite to 48 on the line B, which appears, by the inspection of the rule, to be at 3 of the large division of the right-hand scale of numbers marked at A, 6 of the small division, and about half another? This I will endeavour to explain as follows:—We know that, as we have two figures in the multiplier and two figures in the multiplicand, the product must, of course, consist of three figures at least, and that the third figure from the right-hand to the left is, in numeration, accounted the place of hundreds; therefore I call the commencement of the left-hand scale at A 100, and, of course, the commencement of the right-hand one 1000; therefore our figures stand thus, 3000 + 600 + 50, nearly. Now, as the scale is not long enough to estimate the units or tens, I find, by multiplying the right-hand figure of the multiplicand by the right-hand figure of the multiplier (in my mind) that 48 is the product; hence I know that the last figure of the product (of 48 × 76) I am seeking is 8, and; therefore, instead of 50 I write 48; hence we have 3000 + 600 + 48 = 3648, the answer required.

Now, with regard to Example the Second, where the product consists of five figures, they are thus found:—I place the 1 on the line B, as near as I can estimate, at 498, that is, 4 of the large divisions on the left-hand scale, 9 of the smaller ones, and, as near as I can guess, 8-10ths of a small division. I then find that, as there are three figures in the multiplicand and two in the multiplier, there must be at least four figures in the product, which is the place of thousands in numeration; I therefore call the beginning of the left-hand scale 1000, and therefore the beginning of the right-hand one 10,000. I then look opposite 82 on the slide B, and I find 4 large divisions, which is tens of thousands; therefore we have 40,000, and I find it does not reach quite to one of the small divisions; therefore the number stands 40,000, and not quite 1000. But I estimate it, as near as I can, to be about 2-10ths of a small division. Hence we have 40,000 + 800 = 40,800. But, if I wish to be very exact, I find, by multiplying the two last figures of the multiplicand by the last figure of the multiplier, the two right-hand figures will be 96; hence I am certain that the last figure of the product will be 6 for the unit's place. I then again multiply the last figure of the multiplicand by the first figure of the multiplier, which gives me a

4 in the unit's place (viz. 64); I then add the 4 to the 9, which is 13; I know, therefore, that 3 is the figure for the tens place: our operation will then stand thus, 40,000 + 800 + 30 + 6 = 40,836, the answer.

And here it may be observed, that though I have shown how the operation *may* be performed to the extent of five figures, it is, in actual practice, of little consequence to the measurer who is in the habit of using the rule, being chiefly confined to the journeyman carpenter, sawyer, &c.; and the dimensions they have to take scarcely ever exceed two figures for the multiplier and two for the multiplicand, for in that case other methods are found preferable.

These observations will apply to any of the following Problems; I shall therefore only give them as regards the method of using the rule for their solution.

G. A. S.

(To be continued in our next.)

INQUIRIES.

NO. 127.

ELLIPTOGARAPHIC INSTRUMENT.

Sir,—A description is desired of the best elliptograph for drawing ellipses of the smallest size, with their diameters in any given proportion, without having to shift the instrument before completing them?

I am, Sir,

Your obedient servant,

C—— M——.

NO. 128.—FELT SHOES AND GLOVES.

Sir,—We remember seeing, some years ago, a pair of Felt Shoes, and, the other day, a pair of Felt Gloves. If any of your Correspondents could inform us where or by whom they are manufactured, they would very greatly oblige,

Sir,

Your obedient servants,

Hands and Feet.

Sir,—Your inserting the following inquiries in your very useful miscellany, will oblige

Your obedient servant,

N. E.

Cork, April 9th, 1825.

NO. 129.—TEST OF BAY SALT.

The test for ascertaining the quality of St. Ubes, commonly called Bay Salt, and the reason why some samples dissolve sooner than others? A house in this city, very extensively engaged in the manufacture of provisions, purchased a cargo of very fine-looking salt two years since, but complaints were received from all quarters of there not being salt enough, though the usual quantity was put into the cask. The salt was of a fine white colour and large grain.

NO. 130.—HOW TO CLEAN MOULDY LEATHER.

The manner of cleaning mould, &c. from Russia and other leather?

NO. 131.—CAUSE OF SALT BEEF SPOILING.

Some beef, in tierces, has been returned from England, unsaleable, having become black. The cause is required. Does it arise from the salt or saltpetre? and how could it be remedied?

ANSWERS TO INQUIRIES.

NO. 111.—SPRING WEIGHING MACHINE.

Sir,—I think your Correspondent F. S. M., vol. III., p. 415, will find that the weight of the line itself (if suspended during the experiment, as I apprehend it must have been), between the spring machines and the carriage, will be nearly equal to the difference in the scale of weights drawn forth. It is well known to seamen, that a long cable materially assists itself by its own weight, and that less strain is brought upon the

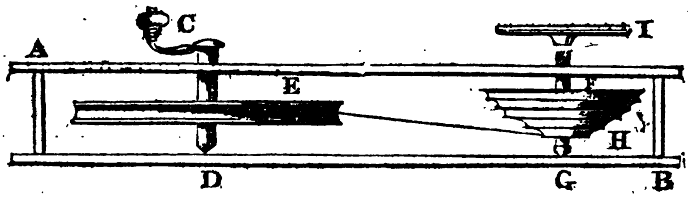
anchor by a long cable than a short one, the strain on both being lessened by the weight between the ship and the anchor. This is particularly exemplified in the use of chain as cable, the difference in weight compensating for the difference in length in the proportion of two to one. Thus, with a chain cable of 100 fathoms, a vessel is supposed to ride as safely as with a rope cable of 200 fathoms.

Should my attempt at elucidation afford F. S. M. any part of the information he requires, it will give me much pleasure.

I am, Sir,
Your obedient servant,
R——. M——.

NO. 100.—CUTTING AND POLISHING CALCAREOUS STONES, ETC.

Sir,—A Correspondent who signs himself "Lapis," in p. 352, Number 78, is desirous of information respecting the best method of Cutting and Polishing Calcareous and Siliceous Stones; if you think the following description of a Mill is worthy of insertion in your Magazine, it is very much at your service. The apparatus is extremely simple and convenient, and may be made by any one poseessing a lathe. It is not new, but has been sold for some years by Mr. Mawe, in the Strand, at from six to eight guineas. The accompanying drawing represents a section of the apparatus.



AB is an oblong wooden box, in which the axles, CD, FG, revolve, and which serves also for a case. E represents a wheel with a grooved edge, and at H is a series of smaller wheels, likewise grooved, by means of which the velocity of the mills may be regulated at pleasure, and the string which connects them may be made more or less tight. At the end, F, of the axle, FG, which projects through the top of the box, is a screw, on which the different mills for grinding and polishing are to be fastened, and by turning the handle, C, it is at once obvious that they will revolve with great velocity. The string may be of catgut, or any thing else more convenient.

In this manner hard siliceous stones may be ground down on the lead-mill, with emery, in a few minutes, and afterwards polished on different mills, using flour of emery and putty. When slitting is required, then the slitting-mill, consisting of a thin plate of iron, is to be screwed on, and the stone to be cut applied to its edge. J. M. N.

NO. 116.

CONSTRUCTION OF CHIMNEYS.

Sir,—The best form or construction of chimneys I know of, for conveying the smoke, is that of the circle, which should not be less than one foot in diameter for a commonsized apartment. I am aware, however, that this form is objected to by architects, as it requires one-third of brick extra in thickness for the chimney shaft. As to the cause why so many smoke the wrong way, I think it is owing more frequently to the carelessness of the bricklayer in building than to any thing else. In fact, neither the architect nor the clerk of the works ever pays much attention to them. Sometimes they are too suddenly contracted at the throat of the flue (a little above the arch of the fireplace); and in other cases, when the flues run crooked, the bricklayers contract them to not more than nine inches by ten inches, nay, I have seen them less than that. The waste lime from the trowel, too, usuallyfinds its way down these flues,

and lodges in the most crooked parts, and stops, in a great measure, the vent of the smoke. Sweep-boys, also, when they are cleansing the chimneys, are almost always sure to leave part of the rubbish.

If "J. T." will take a bricklayer's advice, he will contract his chimneys regularly at the throat, and make them rather smaller there than in any other part. He will also take care not to make them less than nine by fourteen inches, to have them gathered over regularly in all the crooked parts, and to render the whole perfectly smooth. If these particulars are attended to, there will be no fear but the smoke will go the right way.

I am, Sir,

Your obedient servant,

A Young Bricklayer.

NO. 109.—CUTTING SCREWS.

Sir,—A Correspondent, in p. 399, vol. III., wishes to know the cause of Screws being largest at the ends, when cut by the stocks and dies, and how they are to be cut true. This may be effected with good stocks and dies in the following manner:—Take a piece of round bar iron, or a cylinder that has previously been turned in the lathe; let the pin be two or three inches longer than you intend to cut the screw; lay it in a good charcoal fire; suffer it to get cold of its own accord; clean off the scales by draw-filing, and screw it firmly in the vice; open the stocks and put them on the pin, about an inch from the end; screw them sufficiently tight to mark out the threads on the pin; turn them down to within an inch of the other end; tighten the stocks, and bring them up again, and so on, until a full thread is used. I find, from a number of experiments, that wrought iron more strongly contracts heat or cold endways than sideways. This may be proved in the following manner:—Let a hole be punched through the centre of a square plate of iron, touch the edges with a little tallow or soft wax; then put a hot bar of iron through the hole, and that edge on which the tallow first melts will be the endways of the iron; the elastic nature of the iron, and the stocks giving way, are the causes of the irregularity in the screw.

I am, Sir,

Your most obedient servant,

M. Monnom.

NOTICES TO CORRESPONDENTS.

Hammer "believes that the invention of the gun mentioned by O. (page 132, vol. IV.) belongs neither to Blanche nor Pauly, having seen it applied to a flint-lock above twenty years ago."

The Inquiries of H. and F. were undesignedly overlooked.

Communications have been received from M. M.—N. H.—T. C.—Charles M.—B.—G. U. A.—W. K.—C.—A. G. G.—Montis, jun.—W. E. K.—Tempus.—An Old Subscriber—R. M'Pherson.

Errata.—Page 133, col. 1, line 1, for *loaded* read *leaded* gun.—Page 140, col. 1, line 14 from the bottom, for 2475*l.* read 5475*l.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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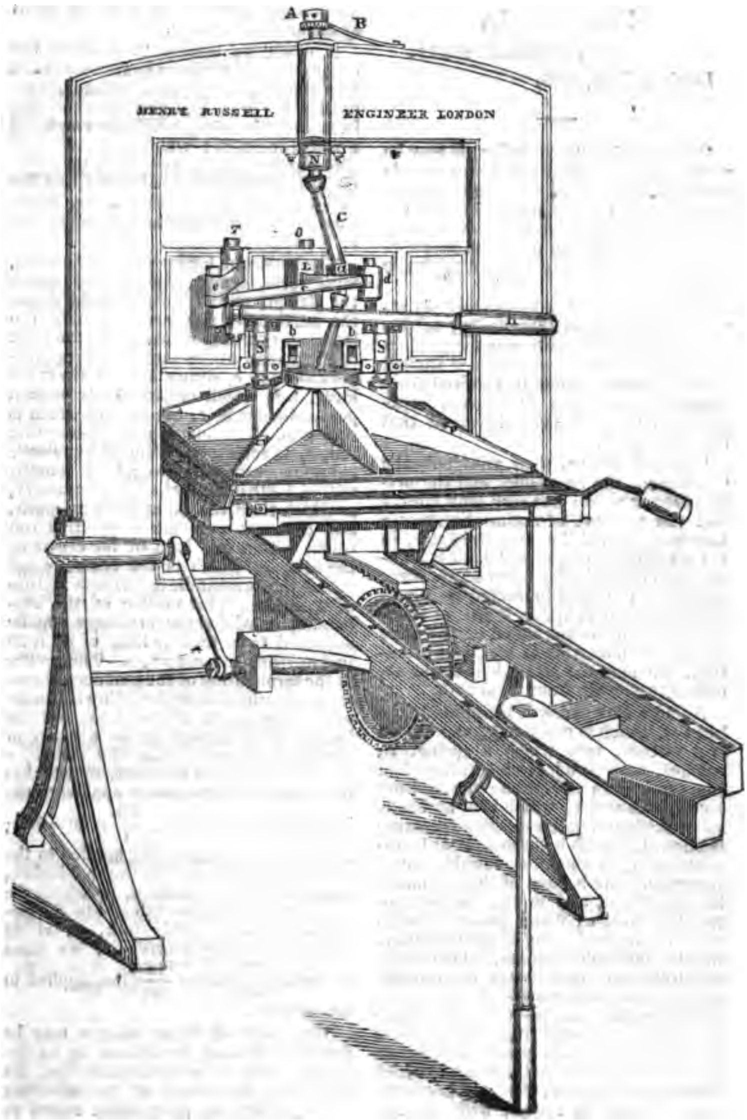
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 95.] SATURDAY, JUNE 18, 1825. [Price 3d.

RUSSELL'S IMPROVED PRINTING PRESS.



IMPROVED PRINTING PRESS.

SIR,—I have sent you a description, &c. of the improved "Russell Press;" as I am now manufacturing them, perhaps you may be pleased to insert it in your Mechanics' Magazine; if so, it is at your service.

I am, Sir,

Yours sincerely,

HENRY RUSSELL.

London, June, 1825.

On inspecting the drawing, it may be readily perceived that the power of this press is derived from the twofold application of that principle which was introduced to the printing press by Lord Stanhope, and which nearly all succeeding press-makers have found it advisable to adopt.

It is now about four years since my attention was turned (practically) to this subject, and the result was the production of that press, called the "Russell Press," which name it received from Messrs. Taylor and Martineau, engineers, in whose service I was at that time employed.

I had, I believe, then seen only the Columbian, the Stanhope, and the original screw press; but very soon after, I had the pleasure of seeing Ferguson's Lectures, edited by Dr. Brewster, in the additional volume of which is a description of a printing press on the same principle, though constructed in a very different manner, by Mr. Wells, of Hartford: but the construction of the press to which I now wish to call your attention, although the principle is the same, differs very much from them both.

An adjusting screw is introduced, the head of which is marked A, and has on it a ratchet, into which a spring, B, catches, to secure it from turning when the press is in operation: the bottom end of this screw, which is of an hemispherical figure, enters the upper pressure column, C, which is hollowed out hemispherically, in a manner suitable for its reception; the bottom of this column is hemispherical, and in like manner enters the bolt, *a*, which passes through the cross lever, L, and is in like manner fitted to the under column, which is also hemispherical, and enters the circular plate, which is secured to the top of the plattin by the two eye-bolts, *bb*. These eye-bolts are entered from the back by a forked lever, which passes through an eye, and has at its end a weight, which bears up the plattin, &c. and keeps the upper column in contact with the adjusting screw: *c*, a rod, connecting the end of the cross lever, *d*, to the lever *e*, which we may consider part of the lever bar, on which is the bar handle, *h*. That the plattin, or upper surface, may always remain parallel with the table, or under surface, two cylindrical rods, screwed into bosses on the upper side of the plattin, and at right angles to its surface, are accurately fitted to the inside of two cylindrical gun-metal guides, which are firmly secured to the back of the press by collar-headed bolts.

It would be useless to describe the other parts, as they are common to most iron presses, except that, instead of employing the drum and girths for carrying in and out the table, &c. I have employed a wheel and rack; which, without considering the injuries sustained by workmen from the breaking of girths, and the loss of time in replacing them, when time is of great importance, I hope will be found preferable.

The pressman having passed the table, with form, tympan, paper, &c. under the plattin, with his right hand draws the bar-handle towards him, until the lever, *e*, comes in contact with the back of the press; at the same time the connecting rod, *c*, draws after it the cross lever, L*d*, which swings freely upon a perpendicular bolt, the head of which is seen at *o*. The length of the connecting rod, *c*, is such as to bring the pressure columns (each six inches in length) within 1-8th of an inch of perpendicular, at which time the impression is given, and the centre of the connecting rod comes within one inch of the centre of the bolt, *r*, which is the centre round which the bar-handle describes a section of a circle. The middle of the bar-handle, or where the pressman may be supposed to be to take hold of it, is 20 inches from the centre, *r*. The power at the termination of the pull may, therefore, be estimated in the following manner:—The length of the lever bar (20 inches) being divided by the distance of the connecting rod from the centre, *r* (one inch), gives a quotient, by which is to be multiplied the power applied to the bar-handle, say 28lbs. $\frac{20}{1} \times 28 = 560$; 560lbs. power is therefore applied to the end of the lever, L*d*, in length 5 inches, which carries the bolt, *a*, by which the pressure columns are brought to the position required. This bolt, *a*, is $2\frac{3}{4}$ inches from the centre, *o*; we have therefore $\frac{20}{11} \times 560 = \frac{11200}{11}$ lbs. applied to the columns.

The power of either column may be found by dividing its altitude by its deviation from a perpendicular line, let fall from the centre of the adjusting screw, which we have before stated to

be 1-8th of an inch. This must be divided by the number of columns, which will be equal (or very nearly) $\frac{48}{1 \times 2} = 24$, which multiplied by $\frac{11200}{11} = \frac{268,800}{11} = 24436\frac{4}{11}$ = tons 10..18..0..20$\frac{4}{11}$. We have made no allowance for friction, which, in this construction, must be very little; and it may be remembered that we applied a power of only 28 lbs. This may, however, be increased by lowering the adjusting screw, and a much greater effect produced.

Taking advantage of the suggestions on the envelope of the Supplement to the third volume of the Mechanics' Magazine, I have to state, that the above presses are to be had only at the manufactory, No. 10, Macclesfield-street, Canal-bridge, City-road.

Super Royal, plattin 20 by 26½, 55*l.*
Cash........... 50*l.*

Warranted two years. Other sizes in proportion.

THE USE OF THE SLIDING RULE.

(*Continued from page* 158.)

PROBLEM II.

To divide numbers by each other.

RULE.

Set the divisor on B to the dividend on A, then against 1 on B is the quotient on A.

EXAMPLE I.

Divide 312 by 24.—Set 24 on B to 312 on A, then against 1 on B is the quotient, 13 on A.

EXAMPLE II.

Divide 3136 by 64.—Set 64, the divisor on B, to the dividend 3136 on A, then against 1 on B is 49, the quotient on A.

PROBLEM III.

To square any number.

RULE.

Set 1 on B to the number on A, then against the number on B is the square on A.

EXAMPLE I.

What is the square of 76?—Set 1 on B to 76 on A, then against 76 on B is 5776 on A, the square required.

EXAMPLE II.

Required the square of 144?—Set 1 on B to 144 on A, then against 144 on B is 20736 on A, the square required.

PROBLEM IV.

To extract or find the square root of any number.

RULE.

Set 1 or 100 on C to the 10 on D, then against any number on C stands its root on D.

NOTE.

If we account the numbers on C as tens, those on D will represent units; if on C hundreds, those on D tens, and so on.

EXAMPLE I.

What is the square root of 144?—Set 1 on C to 10 on D, then against 144 on C is 12 on D.

EXAMPLE II.

What is the square root of 20736?—Set 100 on C to 10 on D, then against 20736 on C is 144 on D.

We may here notice that we must, in this case, reckon the 10 on D as 100, and the 20 as 200, &c.; because we have reckoned on C as thousands, as in the First Example we reckoned on C as hundreds, so on D we reckon as tens, and if we had reckoned the number on C as tens, we must call the numbers not as 10, 20, &c. but as 1, 2, &c.

G. A. S.

(*To be continued.*)

PROPOSITION I.—PROBLEM.

INVESTIGATION AND SUMMATION OF A NEW SERIES, EXPRESSING THE LENGTH OF A CIRCULAR ARC.

(Continued from page 153 of our last Number.)

In the mean time we shall show how the aproximate sum may be determined by means of an infinite series, in terms of the tangent of the given arc, in the following manner:—

$$\text{By Division,}\left\{\begin{array}{l} \frac{n\,t}{n^2\,t^2+2}=\frac{1}{n\,t}-\frac{2}{n^3\,t^3}+\frac{2^2}{n^5\,t^5}-\frac{2^3}{n^7\,t^7}+\frac{2^4}{n^9\,t^9}-,\ \&c. \\ \frac{n\,t}{n^2\,t^2+6}=\frac{1}{n\,t}-\frac{6}{n^3\,t^3}+\frac{6^2}{n^5\,t^5}-\frac{6^3}{n^7\,t^7}+\frac{6^4}{n^9\,t^9}-,\ \&c. \\ \frac{n\,t}{n^2\,t^2+12}=\frac{1}{n\,t}-\frac{12}{n^3\,t^3}+\frac{12^2}{n^5\,t^5}-\frac{12^3}{n^7\,t^7}+\frac{12^4}{n^9\,t^9}-,\ \&c. \\ \frac{n\,t}{n^2\,t^2+20}=\frac{1}{n\,t}-\frac{20}{n^3\,t^3}+\frac{20^2}{n^5\,t^5}-\frac{20^3}{n^7\,t^7}+\frac{20^4}{n^9\,t^9}-,\ \&c. \end{array}\right\}\textit{ad infinitum}:$$

when the law of the coefficients, or numerators, of the serieses in the vertical column is very obvious; the first column being the sum of a series of units, the second the sum of the triangular numbers, the third the sum of their squares, the fourth the sum of their cubes, the fifth the sum of their biquadrates, &c. &c. Whence, by taking the successive differences of each series, we find that the 1st, 3rd, 5th, 7th, 9th, &c. orders of differences become respectively equal to nothing, and, consequently, we can assign the sum of n terms of each series by means of the well-known differential series:

$$s = n\,a + \frac{n\,.\,n-1}{1\,.\,2}\,.\,d' + \frac{n\,.\,n-1\,.\,n-2}{1\,.\,2\,.\,3}\,.\,d'' + \frac{n\,.\,n-1\,.\,n-2\,.\,n-3}{1\,.\,2\,.\,3\,.\,4}\,.\,d''' + \&c.$$

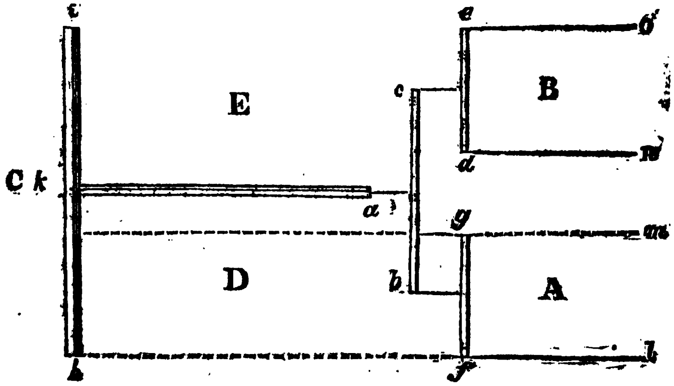
Let, then, a, b, c, d, &c. denote the sums of the 1st, 2nd, 3rd, 4th, &c. serieses respectively, and we shall have $a = \frac{1}{t}$, $b = -\frac{n\,.\,n-1\,.\,n-2+\mathrm{A}}{3\,n^3\,t^3}$, $c = +\frac{n\,.\,n-1\,.\,n-2\,.\,n-3\,.\,n-5+\mathrm{B}}{5\,n^5\,t^5}$, $d = -\frac{n\,.\,n-1\,.\,n-2\,.\,n-3\,.\,n-4\,.\,n-5\,.\,n-6+\mathrm{C}}{7\,n^7\,t^7}$, $e = +\frac{n\,.\,n-1\,.\,n-2\,.\,n-3\,.\,n-4\,.\,n-5\,.\,n-6\,.\,n-7\,.\,n-8+\mathrm{D}}{9\,n^9\,t^9}$, &c.; whence the capital letters, A, B, C, D, &c. represent the sum of all the terms, *minus* the last, which arise from substituting the successive differences in the aforesaid differential series. Now, from the nature of this series, it is evident that the highest power of n in each of the functions, A, B, C, D, &c. will be one dimension less than the highest power of n in the corresponding denominator. It follows, therefore, that when n is indefinitely great, the successive quotients arising from dividing the said functions by the respective denominations being equal to a series of finite, divided by a series of infinite quantities, will be equal to nothing. In this case, also, $n = n - 1 = n - 2$, &c.; because an infinite quantity is not decreased by subtracting a finite one from it. Hence

$a = \frac{1}{t}, b = -\frac{1}{3t^3}, c = +\frac{1}{5t^5}, d = -\frac{1}{7t^7}, e = +\frac{1}{9t^9}$, &c. Consequently the length of the arc, BN, of which $\frac{1}{t}$ is the tangent, is equal to the series $\frac{1}{t}$, $(1 - \frac{1}{3t^2} + \frac{1}{5t^4} - \frac{1}{7t^6} + \frac{1}{9t^8}$ − &c. *in infinitum.*) (2)—Then, by taking BN equal to any given multiple arc whose tangent can be found in terms of the radius, the series will become known, which, being repeated as often as BN is contained in the whole circumference, will give the length of the circumference in terms of the diameter.

This is the very identical series first investigated, for this purpose, from the fluxional calculus, by Mr. James Gregory, the ingenious inventor of the reflecting telescope, which was sent to Mr. Collins in a letter of February 15th, 1671, and inserted in the *Commerc. Epistol.*

(*To be continued.*)

ON THE LINE OF DRAUGHT IN CARRIAGES.



Sir,—The following observations may, perhaps, exhibit nothing whatever but the ignorance of the writer. Dubious as he is, however, of his abilities and knowledge, in respect at least of mechanism, the *possibility* of his observations furnishing a hint which may be practically developed by others into an experiment, is enough to make him hazard the exposure.

Travelling, the other day, on the top of a stage-coach, and observing how the leaders drew, it struck me that the principle on which they drew *might* be exchanged for a better. Give me leave to state my opinion.

Suppose, in the above figure, *a k* to be the pole, *b c* the swinging-bar, *h i* the splinter-bar, and *e d*, *f g*, the trace-bars of the leaders. Now, *b c* being moveable at the point *a*, it is evident that when the leader at A pulls, he pulls the end *b* forward, *ergo*, the end *c* backward, and, *ergo*, the leader at B backward; hence the leader B must exert himself to overcome the drawback of the leader A, and therefore this part of leader B's force is lost to the vehicle at C. In the same way some part of leader A's force is lost to the vehicle. It is not so with the wheel-horses at D and E, for the splinter-bar is fixed (at least nearly so), and therefore the *whole* force of each

wheel-horse is devoted to the vehicle. When the swinging-bar is exactly at right-angles to the pole, that is, when the leaders are both "up to their traces," then, indeed, *b c* may be considered as fixed, and then, perhaps, there is no force lost; but how seldom is this the case? how often do we see the coachman obliged to whip up one end of the swinging-bar? and until it is up, one leader is, in fact, not so much pulling the vehicle as pulling *back* the other leader.

I submit, Mr. Editor, that if there be any truth in this assertion, it would be well to remedy the imperfection I allude to. It is with the utmost diffidence *I* propose any innovation, but why may not the leaders draw like the wheel-horses? why may not the traces, *f l*, *g m*, &c. be continued on, in the dotted lines, to the splinter-bar? and the superfluous machinery of swinging-bars, &c. be thus done away with? The leaders would then exert their whole force on the vehicle; nor does my ignorance allow me to perceive any inconvenience which would result from this reform in stage-coaches, but, on the contrary, a considerable benefit, not only to the horses themselves, but to their owners.

It may be said that it is the swinging-bar which directs the coachman which leader to whip up. I am no Jehu, but I believe it is by the *collars* that a good coachman judges whether a horse be performing his duty. What directs him with the wheel-horses?

I remain Sir,
A well-wisher to the advancement of knowledge,
M—— P——.

NEW MODES OF SCREW-CUTTING.

Screw-Cutting in the Lathe constitutes one of the most curious and useful branches in the art of turning. The common modes now in practice are the screw-tool, the traversing mandrel, and traversing chuck. To cut screws by the screw-tool requires much practice, as the threads of the screw can only be directed by the motion of the hand, which must be moved very steadily along the rest, otherwise the threads will be very uncertain. By the traversing mandrel, only a certain number of threads can be cut, which depends on the number and size that is on the end of the mandrel. The traversing chuck is a new invention, but is very complicated, and cannot be used in some cases. These objections have induced me to adopt two other contrivances for screw-cutting in the lathe, and they surpass all others for simplicity and perfection. The most inexperienced artist may cut a screw to the greatest nicety, and to any length or size he may think proper, from the 100th part of an inch to an inch and half thread. It has also the advantage of cutting left-handed screws, and may be performed by any well-made lathe in the following manner:—A wheel must be made of brass, with any convenient number of teeth, say 36; in the centre of this wheel is a hole for the screw on the chuck of the lathe to pass through into the mandrel, and which may be screwed on with any of the chucks most suitable to hold the work; on the puppet or collar of the lathe is screwed another wheel, of the same size and number of teeth as the former; in the centre of this wheel is fixed a tube, about an inch and a half in length, to receive the head of the screw, which is turned in a globular shape, similar to the pin of a vice; it has a notch sawed rather beyond the centre of the head, and brought up to an angle; a hole must be drilled through the head, crossing the saw-cut a little from the angle, to allow room for a pin to pass through between the angle and the hole you have just drilled; a rivet must be put in the hole, and filed off level to the head of the pin; the globular head of the pin being fastened in the tube by means of a small pin passing through its diameter, has liberty to act as a universal joint; the screwed part of the pin acting on the screw-tool, or parallel rest, draws it steadily along the work, and produces a regular thread; the two wheels act together, both turning inwards, consequently, if a right-hand thread be fixed in the tube, the produce will be left-handed, or *vice versa*. It is my intention to give, in

a future Number, a drawing and description of another easy and useful mode of screw-cutting.

I am, Sir,

Yours respectfully,

M. MONNOM.

CALCULATION OF INTEREST.

SIR,—Observing in your very useful publication of last Saturday, a communication respecting a "mechanical mode of obtaining scientific results" in calculating Interest, at five per cent., I will, with your permission, make a few observations on it, because I conceive it to be any thing but useful, besides being tedious in its application.

His rule is, "multiply the sum by the days, and divide the product by 365, the quotient will be the answer in shillings." Now, if your Correspondent intended to give the world a short and expeditious mode of solving questions in interest, he has erred very widely. I would ask, whether it be easier to divide by 365, to get the answer in shillings, &c. and then divide by 20, to bring that result into pounds, shillings, or pence, or to divide by 365 × 20 = 7300, at once? Every schoolboy knows as well that 1*l.* is the interest of 7300*l.* for one day, as they know that a shilling is the interest of 365*l.* for the same period. Your learned mathematician would make us believe that there is something of importance in his communication, when it is told in his pompous and pedantic style. I never knew that it was easier to divide by 365 than by 73. He will tell us next, I expect, to divide by 30,416, and the quotient will be the answer in pence.

For the present, allow me to ask the following:—If any *sum*, the interest of which is required for one day, be divided by 12,80 and 17,500, and the quotients added to the *sum*, the answer will be given in decimals, inserting the decimal point four figures from the right hand.—Required the reason.

Example.—Suppose the interest of 10,000 for 100 days is required = 1,000,000.

		1,000,000
1-12th	=	83,333
1-80th	=	12,500
1-17500th	=	57
		109,5890 = £109 11 9¾

I do not give the above as a short, though a correct method, but merely, as it is original, to amuse the curious. It is much easier to reduce the interest from five per cent. than to work as above. The five per cent. method shall be communicated in my next, as it is the shortest and most correct method that can be used.

I am, Sir,

Your humble servant,

G. U. A.

June 6th, 1825.

BROWN'S GAS ENGINE.

SIR,—A Correspondent of yours, who signs himself "A Burnt Retort," informed me, in Number 67 of your Magazine, that Mr. George Frasi was making one of Mr. Brown's Gas Engines on the *piston principle*, which was to be finished in about fourteen days; but it is now *six months* since, and I have not heard what progress has been made with it. I should be much obliged if your Correspondent would inform me if it is completed, and working any kind of machinery; and if so, where it might be seen.

I remain, Sir, yours, &c.

A— F— S—.

Commercial-road.

MARINE CRAVATS.

SIR,—Whatever has for its object the preservation of existence in perilous circumstances, is entitled to some consideration. The above figures represent the structure and manner of wearing what I call a Marine or Bathing Cravat. It is merely a cylinder of leather, water-proof, three inches in diameter, sufficiently long to surround the neck and fasten behind with a buckle or clasp.—Within the tube or cravat, at intervals, represented in figure 3, are eight pieces of cork-wood, such as bungs, fixed in the following manner: In the circumference of each a groove is cut, and, when placed at the proper distance from each other, a waxed cord is drawn over the leather upon the groove, which fastens the cork and retains it firmly in that position. The advantage of this separation of the cravat is, that if water should insinuate itself into any of the divisions, it would be cut off from communicating with the others. To render the leather still more impervious, it might be varnished inside with elastic gum. A tube of this dimension exerts a buoyancy of about five pounds, sufficient to render unnecessary any exertion to keep the mouth and nostrils above water. By the use of this simple and convenient

apparatus, any person, though unable to swim, may venture into the deepest water, and there remain suspended in perfect security.

I am, Sir,

Your obedient servant,

Thomas H. Bell.

Alnwick.

DRY ROT.

Sir,—About fourteen years past I was called upon to repair a wood-floor and other wood-work in a room where the Dry Rot had commenced its destructive career. I removed every part of the wood that had the least appearance of its baneful influence, except the sleepers, which were of oak, and slightly injured. I then gave a good coating of hot lime-wash to every part that could be conveniently got at, and closed the work again. About the middle of March last the same destroyer made its appearance in another part of the same room, but I found that wherever the hot lime had been applied in the slightest degree, the wood had not been, subsequently, in the least deteriorated. I have not the least doubt but the application of hot lime will both prevent the commencement, and stop the progress, of dry rot in buildings. The preparation is cheap and wholesome, and easily applied.

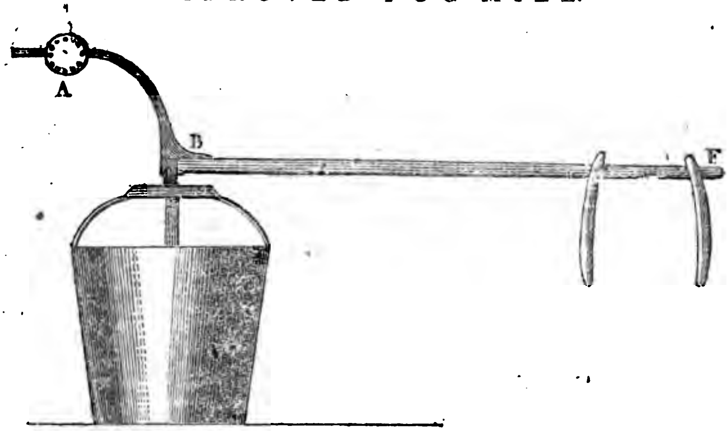
I am, Sir,

Your obedient servant,

A Curious Fellow.

Helstone.

IMPROVED PUG-MILL.



Sir,—Having frequently, of late, opportunities of visiting many of the brick-fields about the metropolis, and examining the various machinery used to grind the clay, I was very much astonished to see the manner in which (in despite of all common sense, not to say philosophy) the common Pug-mills were furnished. I saw a long beam of heavy timber stretching out from the spindle, entirely on one side, and the horse (with every neglect for the "line of draft") labouring, having nearly as much force to exert in order to overcome the friction of the spindle against one side of the collar in which it turns, as was necessary to grind the earth. It is strange that some counterpoise is not *generally* used (as I trust some *individuals* must have had sense enough to adopt it), in order to relieve the poor animal, who certainly has a very "tough job." The objection stated to me, when I proposed it in one place, was, that it would be in the way of the man who wheels the earth to the mill. This was mere prejudice, as the horse moves slowly enough through the arc of a semicircle to allow the man time to empty his barrow into the mill. But were

this objection on proper grounds, there might be a counterpoise fixed in such a manner as to remove this inconvenience. For example, the iron rod, B, might be connected to BF, curved as represented in the figure, and having the metal ball, A, attached to it, so as to slide out or in on the rod; in order that it may be adjusted exactly to poise the horse-beam, BF, it could be kept steady by a small wedge. This improvement, which any person might suggest, I mention merely because no one has hitherto (as far as I know) laid the matter before the public.

I am, Sir,

Your obedient servant,

J. M. M—N.

ANTI-INCENDIARY COMPOSITION.

We are informed by a French Gentleman, now resident in London (No. 20, Newman-street, Oxford-street), that he has discovered a peculiar composition, which is possessed of the admirable property both of preventing and extinguishing fire. It is said not to be expensive, and may be indiscriminately applied to any object whatever. By means of this discovery, not only wood and cloth, but paper and straw, can be actually rendered flame-proof.

PRIZE CHRONOMETERS.

SIR,—My attention has been directed to an article in your valuable Publication of the 4th instant, headed "Prize Chronometers," wherein it is declared most unceremoniously, and as a matter of fact, that I never made a chronometer, and am a mere "dealer and chapman." Now, Sir, although, in my own judgment, I do not feel myself bound to notice this most unfounded attack of your anonymous Correspondent, yet, as you seem to think otherwise, I beg leave, for the information of such of your readers as might have been imposed upon, to say, shortly and strongly, *that it is wholly false and unfounded; and I challenge your nameless Correspondent to avow himself, and attempt to prove what he has so unwarrantably asserted.*

After having been actively engaged in the operative department of my business for thirty years, commencing with an apprenticeship of seven laborious ones, and being at this moment a manufacturer, to a large extent, of chronometers of all descriptions (which, I need not explain to you, includes every machine for the admeasurement of time), I little expected such a charge; but the motive is too obvious to be mistaken, and too *malicious* to have any effect with a discerning public. However, as you have given publicity to this attack on me, I have no doubt you will see the necessity of joining with me in calling on your Correspondent to come forward and avow himself. If he is a "real workman," I shall feel little difficulty in convincing him of the injustice of his charge.

Having made these observations in deference to you, I must declare my intention not again to notice any anonymous attacks; and, in conclusion, allow me to remark, that your valuable Magazine would give more satisfaction to its numerous readers, if you insisted on the name and abode of such a Correspondent as this, before you gave wide circulation to an attack on professional merit or acquirement, however humble.

I remain, Sir,

Your obedient humble servant,

J. M. FRENCH.

Royal Exchange, June 9th, 1825.

In inserting the letter referred to by Mr. French, we did not act so unadvisedly as he seems to suppose. We had heard that, among "real workmen," it was a subject of very general complaint, that they were outstripped in the competition for the prize chronometers by masters who were not workmen; and being earnestly requested by one of their number, who gave us his name and address (for we did not, as Mr. French takes for granted, neglect that necessary precaution), to bring the matter before the public, by the insertion of the letter in question, we thought that by doing so we could do injustice to no one; since the necessary consequence of agitating the matter must be to silence the murmurings of the one party, should they prove unfounded, and to make more honourable the triumph of the other, should it prove to have been fairly achieved. Mr. French has met the charge of not being a real manufacturer by the most positive denial of its truth. He appeals to a life spent in the arduous pursuit of his profession; and he has, besides, been at the pains to satisfy us personally, at a visit which we made to his workshop, that he is, in truth, what all the

world gives him credit for being, a most expert and ingenious workman. But it is said, that he "never made a chronometer himself." If by this it is meant to be asserted, that he never, *with his own hands*, manufactured all the parts of a chronometer, and put them together, no more is asserted of Mr. French than may, with equal truth, be asserted of every other workman. A more extraordinary instance cannot be adduced of the subdivision of labour, and of the benefits arising from it, than this very matter of watchmaking. No less than 34 different classes of workmen are employed in making a plain watch (see Mechanics' Magazine, vol. II. p. 170), while a repeater requires many more; and it is owing to the excellence which each is enabled to attain in his distinct department, that this branch of art has reached such a state of perfection as it has done in this country. The circumstances by which one master manufacturer may fairly hope to be distinguished beyond others, consist in a better choice of materials and workmen, and in a more skilful combination of the different parts, however manufactured or procured; and to every praise that belongs to great eminence in this respect, we think Mr. French is most justly entitled.

The chronometer, No. 1640, made by this gentleman, and which gained the prize of 200*l.* awarded this year by the Board of Longitude, varied only one second and 85-100ths of a second, on its mean daily rate, during the whole twelve months it was on trial at the Royal Observatory; and for the last six months of that period, the variation was reduced *as low as* 45-100*ths of a second.*

It is also greatly to the credit of Mr. French, that his chronometers have been *twice* adopted as the *standard* in surveys made by Dr. Tiarks, by order of Government, for ascertaining the longitude of different places; first of Madeira, and then of Dover, Falmouth, and Portsmouth; and that, in both these instances, they fully sustained the well-earned reputation of their maker. The result in the former instance was particularly remarkable. There were seventeen other chronometers employed on the occasion, and the standard gave the same time as the mean of all these seventeen, *within two hundredths of a second.*

Mr. French has once more entered the lists (which, it is worth observing, are open to every one, whether master or man) for the prizes to be awarded next year; and from the first monthly report (for May) now before us, it appears that out of forty-eight chronometers on trial, one of his, No. $\frac{20}{3912}$, is *that which has varied the least*; the greatest variation from its mean daily rate being *one second and* 3-10*ths of a second.*

Nearer approximations to absolute correctness can scarcely be hoped for, than has been exhibited in these different instances; and while they do honour to Mr. French, they serve to explain why he is so unjustly an object of jealousy and animadversion to his rivals.

We subjoin, as a matter of curiosity, the rate of Mr. French's Chronometer, No. 720, as taken at the Royal Observatory for seven months previous to its being made the standard for computing the longitude of Madeira. The uniformity of its operation is very remarkable.

		"
December	4 (1821)	—1, 1
	10	—1, 9
	15	—1, 3
	22	—1, 4
January	2 (1822)	—1, 7
	14	—1, 9
	28	—1, 6
February	7	—1, 3
	10	—1, 5
	15	—1, 1
	22	—1, 4
March	1	—1, 3
	5	—1, 2
	13	—1, 3
	28	—1, 7
April	4	—1, 2
	13	—1, 5
	20	—1, 5
	27	—1, 4
May	3	—1, 2
	11	—1, 6
	17	—1, 3
	24	—1, 2
	30	—1, 5
June	6	—1, 5
	13	—1, 6
	21	—1, 9
	26	—1, 9
July	6	—1, 7
	11	—1, 7

ENCOURAGEMENT OF INVENTIONS.

We have much pleasure in informing our readers, that the Company which, in our 87th Number, we announced as being in the course of formation for this purpose, has formed a junction with another Society, which had been commenced by other individuals for precisely the same objects, in consequence of a similar feeling of the necessity of

rescuing inventive genius from the numerous difficulties by which it is at present surrounded; and that nearly all the more eminent men of science in the three kingdoms have promised to give the Association the benefit of their counsel and assistance. From the following copy of the Prospectus which they have issued, it will be seen more precisely what their views are, and what the success which they anticipate.

PROSPECTUS.

The prosperity of nations depends on nothing more than the encouragement of the inventive powers of individuals. It is to invention we are indebted, not only for all the arts, but for the most valuable, because the most original, descriptions of public and private wealth. Every other species of property is something gained by individuals from the common stock; but the productions of invention are positive additions made to that stock by individuals.

That Great Britain has been prosperous beyond all other countries, is to be ascribed, however, less to the express encouragement given by her institutions to useful inventions and improvements, than to the fewer obstacles which genius has had to encounter on British ground, and to the profits of successful adventure being greater than in foreign states. It is not speaking too severely of our existing laws on the subject of patent rights, to say that they are not among the least absurd and injurious portions of that mass of unwise legislation respecting trade and manufactures, which the more enlightened policy of modern times is now engaged in effacing from the Statute Book. They have operated solely as dead weights, and in no respect as first movers; nor can it be doubted that, but for these laws, the British people would have been now much farther advanced than they even are in the arts of peace and in genuine prosperity.

Instead of genius being cherished and rewarded as it deserves, it is matter of notoriety that it but rarely reaps the harvest of its own sowing, and that many designs of the best promise are, in consequence of the difficulties which the existing state of things opposes to their development, altogether lost to the world. Is an inventor humble and poor, who is there to advise and befriend him? He has no access to men of science—no patrons among men of wealth; he cannot himself defray the heavy expense of securing by patents the property of his invention, nor even, in many cases, the cost of those preliminary experiments necessary to determine its real value. He seeks among strangers for pecuniary aid, perhaps too for scientific advice, and either falls into the hands of persons who plunder and then forsake him, or, from a natural reluctance to give his entire confidence to a stranger, makes such an imperfect revelation of his plans, that nobody can be induced to patronize them. Is an inventor, on the contrary, in easy circumstances? Although able to pay all the expenses of experimental investigation, he has rarely the conveniences requisite for conducting it; and from not subjecting his designs to this necessary test, he finds, too late, that they are either not worth prosecuting or visionary. Even when he has acted most advisedly in taking out a patent, it is seldom that he possesses the facilities requisite to turn it to a profitable account.

It will be the object of this Society to remedy the various evils here pointed out; to rescue mechanical and scientific genius from unmerited neglect and oblivion; to stimulate the energies of those to whom success has hitherto appeared hopeless; to give to persons of all classes every possible chance of profiting by their inventions and improvements, and thus to call into life and full activity the whole inventive powers, not only of the native-born British subject, but of all who may choose to make this country their home.

The Society propose to make such pecuniary advances as may be necessary in each instance; to establish workshops, where trials and experiments may be made with secrecy and dispatch; to procure the confi-

dential advice, in all cases of difficulty, of those men of science who are most competent to decide upon them, and finally to promote, by an active and extensive agency, the introduction into general use of every patent or other invention and improvement which they shall be the means of bringing forward.

It must be obvious, that an association like this can never be influenced by any of those motives which occasionally tempt individuals to defraud those whom they pretend to assist and patronize. It must depend for its prosperity on attaining and upholding such a character for honour and liberality, that all may, without the slightest hesitation, entrust it with the most candid disclosure of their designs, in the perfect assurance, that if these designs merit support, they will obtain it to the fullest extent.

The Society will depend for its remuneration entirely on the success of each plan in the prosecution of which it may embark; it will expect no indemnity in case of failure, and stipulate only, that when an inventor begins, through their agency, to derive profit from his invention, he shall make a suitable return for the benefit he has received.

As the Society, however, is established equally with a view to public as private good, it is proposed, that as soon as the dividends to the shareholders exceed eight per cent., they shall be limited to one-half of the further profits, and that the other half shall be devoted, in the first place, to the establishment of a National Museum of Machines and Models, and next to the promotion of scientific knowledge among those classes engaged in our arts and manufactures.

In order that mechanics, who are likely to contribute most to the business of the Society, may be still further participators in its profits, it is proposed to call for the capital required by instalments, so moderate in amount, and on such long notices, that even persons of very humble means may find it an eligible medium for the investment of their savings. It is intended that not more than two pounds on each share shall be called for in the course of the first year, and not more than four pounds in any one year thereafter. As there are, however, already many valuable plans awaiting the acceptance of the Society, it is not improbable that the calls on the share-holders may be less.

From the sketch which has been now given of the objects of the Society for the Encouragement of Inventions, it will be seen that it will interfere with the interests of no class of persons, and ought therefore to excite the jealousy of none. It will supply exactly what has been long much wanted, and what will be alike beneficial to all: to the ingenious and industrious mechanic, whose only impediment is his poverty, it will afford all the advantages of a large capital and powerful connexion; to the gentleman of scientific or mechanical pursuits it will furnish facilities which few can at present command; while the public at large will be essentially benefitted by a combination of these advantages, since it will bring to an earlier maturity the fruits of genius, and every improvement in the arts will be more rapidly followed by an increase of production. It will, in short, become the connecting link between genius and fortune.

STEAM ENGINE.

Sir,—Among the various improvements which have marked the progress of scientific information in the United Kingdom, none are more calculated to fix the attention of the British public, or to excite that spirit of inquiry which necessarily precedes and accompanies all speculative projects, than that powerful facilitator of commercial intercourse, the Steam Engine, when applied to the purposes of navigation.

That this spirit of inquiry has been most successfully directed to that important branch of our national enterprise, is strikingly apparent in the rapid advancement towards perfection which has been made in that almost "all-powerful" machine.

Surely, then, it must have been a subject of regret with others, as well as myself, that the application of this extraordinary power should not have kept pace with the power itself—I allude particularly to the adoption of paddle-wheels, as the mode by which the propelling force of steam vessels is applied.

That the process of rowing originally suggested the idea, and that the paddle-wheel, by its rotatory motion, and consequent facility of application, should have appeared and been adopted in the first instance, as not only the most simple, but the closest and most effective copy of that process, I can readily imagine; but that it really is a close and effective copy, I shall endeavour, in the briefest manner I can, to disprove.

For example, suppose the paddle-wheels to be 15 feet in diameter, three of which are immersed in water (and, I believe, they are often much more than that), each float, at the time it strikes the surface, would be at the angle of 34 degrees, and from thence to 44, it must necessarily act upon the vessel more as a lifting than a propelling power. At 45 the force is equal; from 45 to 134, therefore, are the only degrees through which the propelling power predominates. At 135, in rising, it is again equal; from thence, until it leaves the water, at 146, its tendency must be to depress the vessel aft; and although the resistance becomes less as the float ascends towards the surface, yet a considerable power is required to overcome that resistance, which does not contribute its share to the progress of the ship.

It may be objected, that as the lifting and depressing power predominates only in 20 out of 110 degrees, through which the floats pass, and that the principal force through the remaining 90 degrees is a propelling one, the balance must be strongly in favour of the latter. So it is; yet it will be well to recollect, that this sacrifice of power (independently of the shock which the machinery must sustain when the float first strikes the water, and the deafening roar occasioned by the rapid succession of them) is graduated through the whole arc, 90 degrees excepted, that being the only point at which the power is simply a propelling one. Add to this the resistance of the air, which the headway of the ship very much increases, for it is of no use to sing out, "Feather your oar, Jack!" and another strong objection to the paddle-wheel will present itself.

Perhaps, by going to extremes, I can give a more decided character to the argument. Suppose, then, the vessel was laden so that the axle of the paddle-wheels was at the water's edge, in that case, the whole lifting and depressing force would be equal to the whole propelling; so that if an engine of twenty-horse power could, on the simple rowing principle, move a vessel at the rate of eight knots per hour, it would require one of forty to gain the same velocity by such an application of the paddle-wheel.

And now, to put conviction within the reach of that portion of your readers who will be convinced of the disparity of power only by practical demonstration, I would recommend the following experiment in rowing. Instead of taking the water with the blade or paddle of your oar at right angles, passing through and leaving it the same, as all good rowers do, suppose you feather it to the angle of 34 or 35, the consequence would be, that it would either skim the surface, or fly out of the tholes, unless secured by a clasp, or something of that kind, and even then it would require the force of two men to make it take and leave the water, at the same angles which the floats of the paddle-wheels do, and the requital for all your extra labour will be a *loss of speed.*

My object in addressing this paper to you, is merely to show that a considerable loss of power *does* take place in the operation of paddle-wheels; but should these remarks be thought worthy of a place in your interesting Magazine, I will, at an early period, explain myself more fully, by sending drawings of an apparatus, which appear to me calculated to increase the velocity, by ren-

dering the whole power of the engine a *propelling* one.

I am, Sir, yours, &c.

J. HARE.

Ipswich, June 6th, 1825.

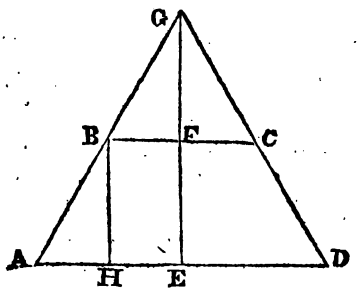
P.S. The *wing system*, invented by Mr. Dixon Vallance, as in Number 81, is certainly ingenious; but as strength must be combined with simplicity, and a constant application of the propelling force is necessary, it appears to me it would be found in some respects deficient.

ANSWER TO INQUIRY.

NO. 89.—IMPERIAL MEASURE.

SIR,—As I consider the answer given by B. C. to J. H.'s problem (No. 105) erroneous, I shall be obliged by your inserting in your valuable Magazine the following:—

A cone is the third part of a cylinder of the same base and altitude (Eucl. x. 12); hence we easily derive a rule for finding the solid contents of a frustrum of a cone.



Let ABCD be the frustrum whose solid contents are required: call the bottom diameter (AD) A, top diameter (BC) a, altitude (EF) h: produce AB, DC, till they meet in G, then find the solid contents of the cones AGD, BGC, their difference will give the solid contents of the frustrum ABCD. But to do this we must first find the altitude of the part BGC, which may be done as follows:—

Draw BH parallel to the axis EG, and the triangles, ABH, BGF, will be similar; therefore AH $(= \frac{1}{2} \quad - \frac{1}{2} a)$: BH $(= h)$ :: BH $(= \frac{1}{2} a)$: HG $= \frac{a\,h}{A-a}$; to this add the altitude of the frustum (h), and you will have $\frac{a\,h}{A-a} + h = \frac{A\,h}{A-a} =$ EG; consequently $A^2 \times \frac{A\,h}{3\,(A-a)} \times .7854\ (f) =$ the solid contents of the cone AGD, and $a^2 \times \frac{ah}{3\,(A-a)} \times f =$ the solid contents of the cone BGC; therefore $A^2 \times \frac{A\,h}{3\,(A-a)} \times f - a^2 \times \frac{a\,h}{3\,(A-a)} \times f = \frac{A^3 - a^3}{A - a} \times \frac{h}{3} \times f =$ the solid contents of the frustrum ABCD; and, as no particular value is given to A, a, and h, it is evident that this is a general formula for finding the solid contents of a frustrum of a cone.

This premised, we shall now proceed to the solution of the problem.

Let the bottom diameter be denoted by x, then (per quart) $7 : 10 :: x : \frac{10\,x}{7} =$ the top diameter and perpendicular depth $\frac{1000\,x^3}{343} - x^3$ (difference of the cubes of the diameters) $= \frac{657\,x^3}{343}$, which $\div \frac{3\,x}{7}$ $(= \frac{10\,x}{7} - 2$, difference of the diameters) $= \frac{657\,x^2}{147}$, which $\times \frac{10\,x}{3}$ (third of the depth) $\times .7854$ $= 1{,}6715\,x^3 = \frac{277.274}{2} = 138.637$ (cubic inches in two quarts); whence $x = \sqrt[3]{\frac{138.637}{1.6715}} = 4{,}362$, diameters of the bottom of the two quart measures in inches, and $\frac{10\,x}{7} = \frac{43{,}62}{7} = 6{,}231$, top diameters.

By proceeding in the same manner, the dimensions of the quart, pint, and half-pint measures, will be found as follows:—

QUART.

Bottom diameter . . .	3,4621 inches.
Top diameter and perpendicular depth .	4,9458

PINT.

Bottom diameter . . . 2,7479

Top diameter and perpendicular depth . . } 3,9254

HALF-PINT.

Bottom diameter . . . 2,1811

Top diameter and perpendicular depth . } 3,1158

To find the thickness of the metal at top, take half the difference between the top diameters of the enclosed and enclosing vessels, and you have the thickness required. Thus, the top diameter of the two-quart measure has been found to be 6,231 inches, and the top diameter of the quart 4,9458 inches; difference 1,2852, which, divided by 2, gives 6426, the thickness required.

To find the thickness at the bottom, take the difference between the top and bottom diameter of the enclosing vessel, and the difference of the depths of the enclosed and enclosing ones, and thus say, as the depth of the enclosing vessel is to the first difference, so is the second to the difference of the diameter of the bottom of the enclosing vessel and its diameter at the bottom of the enclosed one, which difference, added to the bottom diameter of the former, will give the diameter at the bottom of the latter; from which take the bottom diameter of the enclosed vessel, and half the difference will be the thickness required.

Thus the top and bottom diameters of the two-quart measure have been found to be 6,231 and 4,362 inches; consequently their difference is 1,869; the depths of the quart and two-quart measures have been found to be 4,9458 and 6,231 inches, difference 1,2852; therefore 6,231 : 1,869 :: 1,2852 : 3,855, added to 4,362, gives 4,7475, from which take 3,4621, and you will have 1,2854, half of which will give the thickness of the metal, at the bottom of the quart measure, 6427. The difference of the depths of the enclosed and enclosing vessels will be the thicknesses of the bottoms.

The following are the thicknesses of the metal in the quart, pint, and half-pint measures:—

QUART.

Top . . . . .6426 inches.

Bottom 6427

Of Bottom . . . 1.2852

PINT.

Top 5101

Bottom 5102

Of Bottom . . . 1.0203

HALF-PINT.

Top 4048

Bottom 4049

Of Bottom . . .8097

The thickness of the sides of the vessel are calculated perpendicular to the axis of the cone, not perpendicular to the blank sides.

I am, Sir,

Your obedient servant,

WILLIAM LAKE.

Bulbourne, near Tring,
March 22, 1825.

[In a former communication of mine (Vol. III. No. 78, page 350) I find one or two typographical errors. In the first column, for "*and that* the *variations* of a degree in latitude," read "*although* the *variations*," &c. Second column, for "consequently the descent of a heavy body from *within one* second," read "consequently the descent of a heavy body, for *rest*, is one second," &c. &c.]

The Managers of the Mechanics' Institutions are respectfully informed, that they may, on application to our Publishers, be supplied, gratis, with proof copies, framed, of the Portrait of their distinguished friend and advocate, Mr. Brougham; *and that our Publishers will make a liberal deduction from the price of all Books purchased for the use of the Mechanics' Institutions and Schools.*

Notices to Correspondents in our next.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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Mechanics' Magazine,

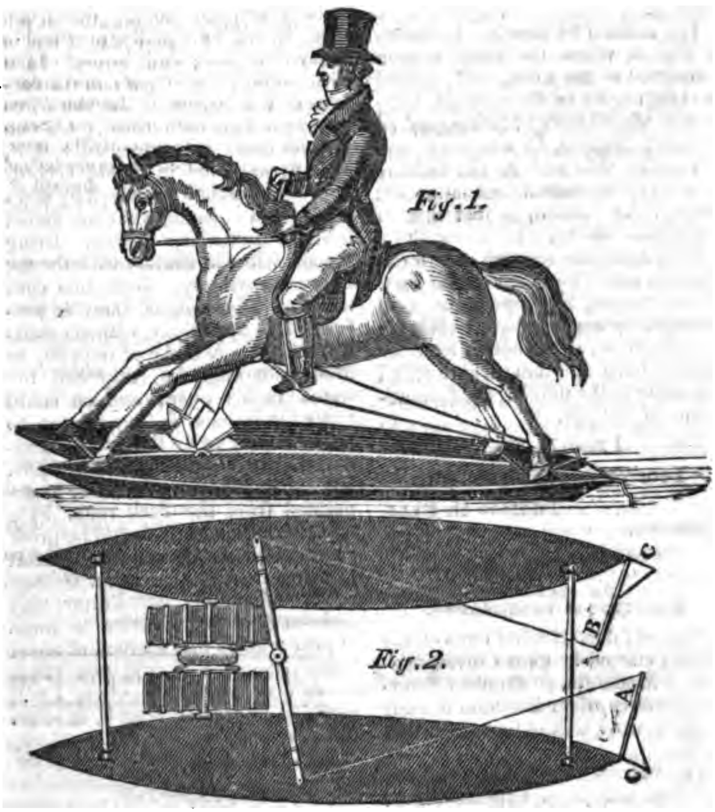
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 96.] SATURDAY, JUNE 25, 1825. [Price 3d.

"No man ever reached to excellence, in any one art or profession, without passing through the slow and painful process of study and preparation."—*Horace.*

DESCRIPTION OF A WATER-HORSE,

BY T. M. BELL, OF ALNWICK.



DESCRIPTION OF A WATER-HORSE.

Sir, — It is good sometimes to unbend, and study the agreeable. I present you, therefore, with a drawing of a Water-Horse, which I have constructed. The body of this *aquatic steed* is a frame of wood, covered with canvas. The canoes, six feet long, are composed of skin stretched on a frame, and made perfectly water-tight above and below. The motion is communicated to the paddle-wheel by a strap passing over a wheel in the shoulder, turned by either hand with a wince. A rudder is affixed to each canoe, and connected by an iron rod to a cross-beam which passes beneath the horse, and, moving on a pin at the centre, with a stirrup-leather at each side, serves at once to support the feet and work the rudders.

The manner of steering is shown in Fig. 2, where the beam is seen connected to the arms, AB, placed at right angles to the rudders, CC; so that when the right foot is pushed forward, the arm, B, advances, and A recedes, thus making the rudders form a correspondent inclination, or, simply, the motion, is just that of the hammer-lever.

Very agreeable *equestro-aquatic* excursions might be taken on the back of this floating Hippopotamus, and, perhaps, by means of your valuable miscellany, we shall shortly have the satisfaction to find that we have added one more to the novelties and amusements of the age.

I remain, Sir,

Your very obedient servant,

Thomas H. Bell.

Alnwick.

ELECTRICAL TELEGRAPHS.

Sir,—If the following hints on the subject started by your Correspondent, "Moderator," should be worthy of notice, their insertion in your valuable work will oblige a constant reader.

To whatever length the conducting wires have been extended, and, if I mistake not, experiments have been made to the extent of *nine* miles, the shock has invariably returned, without any perceptible loss of time. If the same results will hold good to the distance of several hundred miles, and I see no reason to doubt it, it is, of all known means, the best calculated for telegraphic dispatch. The great number of stations at present necessary would be reduced to one at each extremity; and, what is of more importance, the communications may be made by night or by day, in hazy or clear weather.

The method of working may be, I imagine, effected by the following simple means:—The present telegraphic communication is effected by means of six shifting boards, in a manner with which your readers are doubtless conversant. Now, if it be practicable to lay down one wire, it will be equally practicable to lay down six; and the cost of the wire would be nearly all the difference in the expense. Let the wires terminate in a dark room. On one wall let there be the figures, 1, 2, 3, 4, 5, 6, prepared in *tinfoil*, according to the method practised by electricians, in forming what are called *luminous modes and figures*. Bring the six wires in contact with the six figures separately. With this contrivance, all the signals may be performed, as at present, with six shifting boards. A shake of the arm, as Moderator suggests, may call the watch to his duty; and he could name the signals, as they appear, to his assistant, as is the present custom in the established telegraphs. His assistant must, of course, be separated from the dark room by a slight partition, that should be proof against light, but not against the full hearing of the human voice.

These few hints, Mr. Editor, may serve as food for reflection to some of your readers who are fond of novel improvements. Should you think the subject worthy of notice, I will explain, at greater length, at some future time.

I am, Sir,

Yours, respectfully,

R—— H——.

CASE OF THE SHIPWRIGHTS.

By inserting the following letter, we by no means intend to convey any opinion of our own on the points of difference between the Master and Journeymen Shipwrights, but simply to open our pages to a candid discussion of the question. We dare say the journeymen will not leave our "Ship-owner" unanswered.

SIR,—Being one of a numerous class who have lately suffered much inconvenience, as well as loss, by the combination of Shipwrights for increased wages, it may not be amiss to show, through the medium of your publication, the injurious consequences which must result, at no very distant period, to those misguided, stubborn, and short-sighted workmen who are the cause of the evil. In a trade where workmen are known to earn from 70*l.* to 90*l.* per annum; paucity of wages is a bad plea. The object of these men is for an increase, and obviously also to form such laws or standing rules amongst themselves as will regulate the rate of labour, not only at their will, but also render it imperative upon all to employ the workmen belonging to their Union. This species of dictation cannot be submitted to tamely; the evil has driven myself and many others to the necessity of seeking a remedy elsewhere. Several vessels in which I am interested required rather extensive repairs, which, from the cause stated, I could not get effected here, and they have been sent to the North of Europe in this imperfect state at my own risk; and I have now the satisfaction of knowing that I shall there accomplish my repairs in an equally secure manner, and at a much less expense, in some cases for one-half, and in no instance for so much as two-thirds, of the cost of effecting such repairs here. In this way some thousands will be expended, and I confess it would be more gratifying to my feelings to expend this at home than in employing foreigners; but when they evince a proper feeling of respect to those who do employ them—when they work well, and also cheap, employing them is decidedly more satisfactory than giving way to insolence at home. The extent to which this remedy has been sought this year is considerable, and the effect of turning the stream of capital cannot be far remote; the extent to which this mode of relief will be sought, will be equally general, as is the desire of man to take care of his own interest. My object in writing this letter is to show the effect produced by an unnatural cause; and as, on comparison, it is found that the wages of labour are already by far too high in this country, abundance of employment will only eventually be secured, in a permanent shape, by a very serious reduction. Until that takes place, we must continue to employ foreigners, when it is manifestly our interest to do so.

I am, Sir,
Your obedient servant,
A SHIPOWNER.

USE OF THE SLIDING RULE.

(*Continued from page* 163.)

PROBLEM V.

To find a mean proportional between two numbers.

RULE.

Set either of the numbers on C to the same on D, then against the other number on C stands the mean proportional on D.

EXAMPLE I.

Required the mean proportional between the numbers 71 and 274?—Set 74 on C to 71 on D, then against 274 on C stands 139 on D.

NOTE.

Here we reckon the 10 on D as hundreds, as in the former problem.

EXAMPLE II.

What is the mean proportional between 5 and 20?—Set 5 on C to 5 on D, then against 20 on C stands 10 on D, the mean proportional sought.

PROBLEM VI.

To find a third proportional to two given numbers.

RULE.

Set the first number on B to the second on A, then against the second on B stands the third proportional on A.

EXAMPLE I.

What is the third proportional to 26 and 48?—Set 26 on B to 48 on A, then against 48 on B is 89 on A, the third proportional.

EXAMPLE II.

Required the third proportional to 144 and 864?—Set 144 on B to 864 on A, then against 864 on B is 5184, the third proportional on A, as required.

PROBLEM VII.

To find a fourth proportional to three given numbers, or, which is the same thing, to perform the operation of the *Rule of Three.*

RULE.

Set the first term on B to the second on A, then against the third term on B stands the fourth term, or number required on A.

EXAMPLE I.

What is the fourth proportional to 12, 18, and 36?—Set 12 on B to 18 on A, then against 36 on B is 54 on A, the fourth proportional required.

EXAMPLE II.

If 30 deals cost 9*l.*, what will 180 cost?—Set 30 on B to 9 on A, then against 180 on B stands 54 on A, which is 54*l.*, the answer.

NOTE.

The foregoing Problems apply, it will be observed, to the use of the rule, as regards the working of abstract numbers; we will therefore proceed to its application to the purposes of mensuration, as regards artificers' work and the art of guaging.

PROBLEM VIII.

To find the area or superficial content in feet, &c. of any board or plank.

RULE.

Set 12 on B to the width, in inches, on A, and against the length on B is the superficial content in feet and tenth parts of feet on A.

EXAMPLE.

What is the superficial content of a board whose width is 2 feet 6 inches, and length 14 feet 4 inches?—Set 12 on B to 30 (as 30 inches equal 2 feet 6 inches) on A, then against 14⅓ (as 4 inches is the third of a foot) on B stands 35 feet, and very near another foot, which we may estimate at 10 inches; the answer is therefore 35 feet 10 inches, which, if we try it by cross multiplication, we shall find correct.

NOTE.

It may be here necessary to observe, that the number 12 is stamped on the rule itself, on the line A, at the ten small divisions on the right hand scale, and also between the lines B and C at the same point; it is also on the line D, which will be explained as we proceed.

G. A. S.

(*To be continued.*)

ANTI-INCENDIARY COMPOSITION.

SIR,—In consequence of a statement appearing in your publication of Saturday last, that a French gentleman had discovered a composition which will render timber, &c. flame-proof, I deem it proper to apprise you that the Lords of the Treasury have now under their consideration a communication made by me on the same subject.

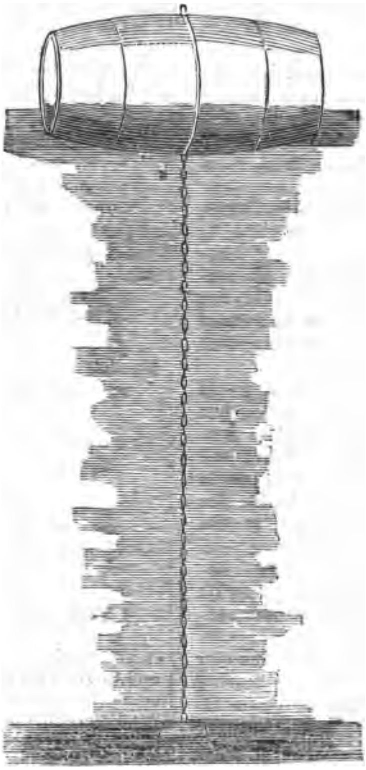
I remain, Sir,

Your most obedient servant,

R. W. DICKINSON.

Retreat, Albany-road, Camberwell,
June 22nd, 1825.

PLAN FOR MOORING SHIPS IN ROADSTEADS.



SIR,—In so commercial a country as England, it has often surprised me that no attempt has been made for effectually Mooring Ships in Roadsteads, as every heavy gale of wind is sure to be followed by an account of vessels driven from their anchors, on some part of the coast, too frequently accompanied by a melancholy catalogue of loss of life and property. The following plan is therefore submitted, with due deference, to the public, and if it should be the means of saving a single vessel from shipwreck, the object of the writer will be attained. The plan is very simple, and will at once be understood from the figure. It consists merely in securing a large buoy in such a manner to a block of cast iron, that it cannot possibly be moved by stress of weather, to which a vessel can be made fast, instead of letting go her anchor.

Construction.

	Ft.	In.
Length of buoy...............	16	0
Diameter of ditto at the middle	8	0
Ditto at the ends..	7	2
Thickness of sides at the middle	1	0
Ditto at the ends..	0	7
Ditto of ends..................	0	8
Cubic content of air...........	414	0
Length of chain................	34	0
Diameter of cast iron block at bottom....................	4	6
Diameter of cast iron block at top	3	0
Height of ditto................	2	6
Weight of ditto.........5½ tons.		

A strong iron hoop passes round the centre of the buoy, to which the chain and ring are made fast, and the chain must be of sufficient length to allow the buoy to rise to the surface at high water.

The cast-iron block must be sunk into the bottom of the sea by means of the diving-bell, until the top of it is level with the ground; and if any additional security is required, piles may be driven round it.

It is conceived, that a buoy of these dimensions would be sufficient to hold a vessel of three or four hundred tons burden under any circumstances; but for large vessels the dimensions ought to be increased considerably, as that would enable them to ride much easier.

The principal cause of a vessel dragging her anchor, or parting her cable in a gale of wind, is the jerk that is produced by a heavy sea striking her when the cable is on the stretch. By the proposed plan this would be guarded against, as the tendency of the buoy to rise perpendicularly, while the ship pulled horizontally, would cause a spring on the cable, so as to prevent any sudden jerk.

A vessel moored in this manner would probably not require to veer out more than twenty or thirty fathoms of cable; and the best manner of bringing up would be, to make fast a hawser to the buoy, heave upon it until the latter came under the bows, then pass the cable (of iron) through the ring of the buoy, and bring the end on board; the cable would thus be double, and a vessel could get under weigh in an instant by letting go one end of it.

Buoys of this description might be laid down (in the Downs, for instance) in lines, at different distances from the shore; and a vessel, instead of looking out for good holding-ground, might bring up as near to the land as her draught of water would permit her, by which means her communication with it would be much facilitated. They might also be laid down in rocky ground, where ships cannot anchor at all; for when, by means of the diving-bell, rocks can be blasted under water with so much facility, it is surely not unreasonable to suppose, that by the same means bolts might be fixed in them sufficient to hold any vessel. That the plan here submitted is feasible, may perhaps appear from the use of mooring chains in several of our harbours, which is very much analogous to it.

To submit any thing of the kind to the Government is generally up-hill work; but if this should happen to come under the notice of the Gentlemen at Lloyd's, perhaps they may think it worth a trial.

I am, Sir,

Your obedient servant,

M——.

Dublin.

METEOROLOGICAL JOURNAL FOR MAY, 1825.

BY DR. BURNEY,

Of Gosport Observatory.

[*To be continued Monthly.*]

[We have to express our obligations to Dr. Burney, of Gosport, for his kind offer to enrich our pages with a regular report of his meteorological observations at Gosport. The one with which we commence will give our readers a good foretaste of the instruction and entertainment they may anticipate from the pen of this able and intelligent observer.—Ed.]

The first part of this month was wet, and the latter part generally dry. Several sudden transitions have occurred in the temperature of the air, as is commonly the case in May; and slight frosts in the nights of the 13th, 14th, 27th, and 28th. Some of the days and nights have been 13 degrees colder than others, and the decrease in temperature between the 24th and 28th was 30 degrees. The showers of rain and heavy dews after the hot sunshine have been found beneficial to the grass lands, the young wheats, and to vegetation in general. From the thundery state of the prevailing compound modifications of clouds, produced by opposing currents of air, several blight days have been experienced, which, with

the before-mentioned frosty nights, did great injury to the wall-fruits, and destroyed a great part of the pears, plums, &c. that seemed to have been firmly set.

In the nights of the 4th, 5th, 6th, 15th, and 23d, there was much sheet lightning, which sometimes terminated in storms of rain, and loud claps of thunder, from the passing nimbi; and the greater part of the day of the 28th, we had vivid lightning and thunder, accompanied with heavy passing showers of rain and hail. As often as thunder clouds have appeared in the daytime, the upper and under currents of air have either crossed each other at right angles, or met from nearly opposite points of the compass; and, from the position of the vanes and the motion of the clouds, their electrical state appeared to have been occasioned by their different united temperatures. The mean temperature of the external air this month is two and a half degrees higher than that of last May, and upwards of one degree higher than the mean of that month for a long series of years. The mean temperature of spring water has increased one degree this month.

The atmospheric and meteoric phenomena that have come within our observations this period, are four solar halos, six meteors, two rainbows, lightning six different nights, thunder on two, and four gales of wind, or days on which they have prevailed, namely, three from N.E. and one from S.E.

The double rainbow that appeared between six and seven o'clock in the evening of the 28th instant, was remarkable for its continuance, and its many bows of colours. The yellow, orange, and faint violet, of both the interior and exterior bow, were very bright for nearly a quarter of an hour. Under the yellow of the interior bow there were three light crimson bows, with two light green bows between them; so that eight distinct bows of colours composed the interior rainbow—a circumstance that seldom happens in the appearance of this beautiful meteoric iris.

Evaporation for the month, 4.900 inches; rain in the pluviameter, near the ground, 2.995 inches; rain in ditto, 23 feet high, 2.730 inches; prevailing winds, N.E.—Scale of the prevailing winds:—N. 3; N.E. 7; E. 4; S.E. 4½; S. 3; S.W. 4; W. 3; N.W. 2½—31 days.

Clouds.—Cirrus, 21; cirrocumulus, 21; cirrostratus, 29; stratus, 1; cumulus, 25; cumulostratus, 27; nimbus, 18.

Summary of the Weather.—A clear sky, 4; fine, with various modifications of clouds, 17; an overcast sky, without rain, 4½; rain, 5½—31 days.

Gosport Observatory,
May 31, 1826.

Eclipse of the Moon.—The southern side of the earth's shadow came in contact with the earth's northern limb at 11h. 46m. 34s. P.M. mean time, here; the greatest shade upon the moon's upper limb, or middle of the eclipse, was at 12h. 1m. 19s., and the end of the eclipse at 12h. 15m. 50s. There were no interesting appearances in this eclipse, as it was merely an apparent contact of the earth's shadow with the moon's upper limb: as they passed each other, the greatest shadow of the earth upon the moon's disc being only the 58th part of her diameter: viewed through an achromatic telescope, it appeared very little more than a tenumbra upon the moon's northern limb, as the latter was well defined at the middle of the eclipse. For a quarter of an hour before the beginning of the eclipse, the lunar light on the S.E. side of the moon gradually diminished in brightness: this arose from two circumstances, namely, the approach of the tenumbra towards the moon, and the motion of the earth's shadow and the moon towards each other, as a contrary appearance to this phenomenon took place at the separation of the shadow from the moon.

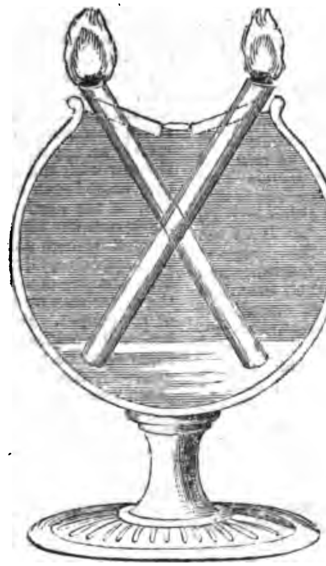
OIL FOR WATCHES.

SIR,—I observe the Society of Arts and Sciences has proposed a premium for purifying oil for watchmakers, &c., and I observe that the matter has been mentioned in your Magazine; you will therefore, perhaps, excuse me for troubling you on the subject.

When I was a boy, now almost threescore years ago, I was acquainted with a very ingenious and clever clock and watch maker in a market-town in the North of England, and I perfectly well remember that his method of obtaining pure oil for use, was to pour a quantity into a small phial and expose it to the action of the frost. The greater portion of the oil froze, but there were always a few drops which did not, and this was the oil he used in his trade, and I have heard him say it answered the purpose perfectly. Although we have not had, in London, severe frosts for several years, yet immersing a phial in ice would, I imagine, produce the same effect.

CAMBRIENSIS.

IMPROVED AGEDABLE LAMP.



Sir,—The following is a description of an improvement in the small glass globe-lamp, which I have found to answer extremely well. The above figure is intended to represent a section of one of them of the full size, with two sockets for cotton wicks or burners, crossing each other in the middle, which brings the light of each of them near the edge of the opening of the glass, and is much better than having them in the middle, because it makes less shade; they reach, also, near the bottom of the glass, and are perfect cylinders, because, when constructed in this way, they will burn all the oil out, with very little, if any, diminution of light, which they would not do if constructed in the usual way, that is, very short, and larger at the bottom than at the top. The slit, also, that is left to introduce a pointed instrument to pull up the wick with, must be very short, and by no means reach below the tin cap, as is usual in the common lamps. The tin cap must be made in the shape of a very shallow broad funnel, just wide enough to cover the opening of the glass, to the inside of which must be fitted a cork, in a similar manner to those that are made to stop the glass ink-stands in a writing-desk. The cork must be cut so as to fit tight into the mouth or neck of the glass, and through the hole the two tubes must be fitted, and carefully soldered to the tin; they may also be soldered together in the middle, where they cross each other. In the middle of the tin cap there must be a hole to pour the oil in, which, after the first time, may be done after the wicks are lighted, and without any danger of spilling the oil, and, when filled, this hole must be stopped with a vial-cork or small peg of wood.

A very small hole must be punched in the tin cap, through which, with a small bit of wire, may be burned an oblique hole through the cork, to admit a little air, otherwise it would not burn at all; the tubes ought to be very smooth at bottom, that the cotton may slip up without catching, which may be done by turning the tin up a little, and soldering it round. When the whole is finished in this manner, it may even be turned upside down, after it is lighted, without spilling the oil.

The cotton cannot be too slack in the tubes, provided it will bear the necessary shaking without danger of slipping down; and to prevent them from smoking, be careful to keep the wicks low enough, for it is their being too high that makes them smoke.

To make it handy for carrying about, the glass may be fitted to a stand made in the shape of a broad, shallow, inverted funnel, by thrusting the stalk of the globe tight through the top of it; and having a little handle fixed to the side, it will then stand of itself, or upon a candlestick, as is most convenient.

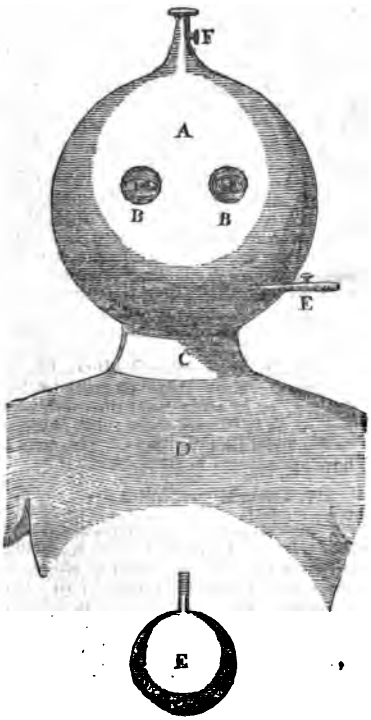
The glass globe ought to be made with a very short thick neck, instead of a curl, as they generally are, for the better fitting of the cork.

I am, Sir,

Your obedient servant,

W—— C——.

NEW DIVING APPARATUS.



Sir,—It having frequently occurred to me that an apparatus, upon an economical and simple plan, might be invented to enable persons to descend to certain depths under water, instead of the expensive method of the diving-bell, I take the liberty of handing you a short description of a plan for the purpose, and shall be much obliged by its insertion in your widely-extended publication.

The condensation of air into a smaller space than it naturally occupies, is effected by the most simple means, and might be easily made applicable to many more purposes than it is at present, and it is upon this principle that the present plan depends. If a diver or any person who has occasion to be under the surface of the water for a considerable time, could, while there, breathe air of about the same density as on the surface, and if any means can be devised to keep it sufficiently pure for respiration, he might remain under water as long as these effects could be continued.

The following description of an apparatus which would contain a supply of air, and keep it in a state of purity, will not, I think, be wholly uninteresting to your readers.

I am, Sir,

Your most obedient servant,

T—— B——.

Leicester.

N. B.—Upon an average, every time a man breathes he consumes about forty cubic inches of air; this is 800 inches per minute, allowing him to inspire every three seconds, and 48,000 inches in an hour. One and a half cubic foot of air, which contain 2592 inches, would be enclosed in a vessel of about seventeen inches diameter, and, condensed twenty times, would be more than 50,000 inches; so that a man might breathe for an hour, and then the equilibrium would scarcely be restored. The size of the apertures would be exactly ascertained upon the same principle as the Argand burners for gas.

Description.

A is a head-piece of strong copper, made in a globular shape, and sufficiently large to admit the head and neck to move without inconvenience.

BB, two strong glass lenses, to enable the divers to ascertain the forms and situations of objects.

C is that part of the head-piece which forms the collar for the neck.

D is a leathern dress to be attached to the collar, C, to fasten tight over the breast and back, with sleeves for the arms, fastened tightly at the wrists, which will prevent any water from being admitted, and preserve the divers from any injuries by coming in contact with the rocks, &c. This dress should be covered with a varnish, to prevent it from absorbing moisture.

E is a strong globe of copper, which the diver may fasten to any part of his dress which is most convenient for him, and attached to the stop-cock, E, by means of a screw and a flexible tube. In this globe are condensed, by a forcing-pump, 10, 15, or 20 atmospheres of common air. This, being a separate part, may be taken off at pleasure, and globes of different sizes substituted, according to the length of time a person has to remain under water.

F is a stop-cock, terminating in a head, which contains a number of very small holes, covered with a valve.

When used, nothing more is necessary than to fit the head-piece, A, with its collar, C, and the dress, D; charge the globe, E, and screw it on the stop-cock, E, in the lower part of the head-piece; turn the stop-cocks, E and F, and all is ready, when any person may, without danger, plunge into the water: he can lower himself, by means of weights, to any depth, and raise himself up again by a rope to the boat above; while the constant stream of fresh air from the small aperture of the cock, E, will enable him to breathe freely, while the foul air is continually forced out at the stop-cock, F, and his atmosphere is preserved pure and respirable. When he perceives the current of air from the cock, E, to become weaker, he would conclude that it had nearly restored its equilibrium, and ought to ascend, while the water is prevented from entering by the valve closing over the apertures at F.

EXPANSIVE POWER OF FREEZING WATER.

In Dr. Dwight's Travels in America there is the following passage:

"Friday morning, October 18th (says he), we rode to the south end of the lake, accompanied by Mr. Whittlesey, to examine a rock, of which a singular, not to say an incredible, opinion prevails in the vicinity. Our road, for near half a mile, lay on a natural causeway, about thirty feet in breadth, which separated the lake into two parts, and was formed of earth, probably washed up by its waves. The rock which was the particular object of our curiosity, is said, by the inhabitants long settled here, to have moved a considerable distance from the spot where it anciently stood towards the south-western shore. You will not suppose we considered this story as founded either in truth or good sense. However, having long believed it to be prudent, and made it a regular practice, whenever it was convenient, to examine the foundation of reports credited by sober men, I determined to investigate this, as I saw that it was firmly believed by several discreet persons. One particularly, a man of unquestioned reputation, and long resident near the spot, declared, that 40 years since, the top of this rock, at the ordinary height of the water, was at least two feet below its surface, and 15 or 20 rods farther from the causeway than when we saw it. The shore has unquestionably remained as it then was; for the trees and stumps standing on the causeway are older than any man now living, and the space between them and the lake is very narrow, scarcely extending 15 feet from the trees.

"The top of the rock is now at least two feet above the water. This height it is declared to have gained imperceptibly, year by year, for many years, in consequence of its advancing towards the shore, and standing continually in water more and more shallow. The water is evidently of the same depth now as formerly, as is proved by the appearance of the shore.

"When we came up to the rock, which was standing where the water was scarcely knee-deep, we found a channel behind it, towards the deeper water, formed in the earth, about fifteen rods in length; it was serpentine in its form, and was sunk from two to three feet below the common level of the bottom on its borders. In the front of the rock, the earth was pushed up in a heap, so as to rise above the water, declining, however, at the distance of a few inches, obliquely and pretty rapidly. Not far from this rock, we saw another much less, attended by the same phenomena, except that they were diminished in proportion to its size. The whole appearance of each was just as one would expect to find, if both had actually removed from their original places towards the shore, throughout the length of their respective channels. How these channels were formed, or by what cause the earth was heaped up in front of these rocks, I leave to the divination of others. The facts I have stated, as I believe, exactly."

Dr. Dwight continues:—

"Several years since this account was first written, I met with the following paragraph in the collections of the Massachusetts Historical Society, vol. III. p. 240:—'There is a curiosity to be seen in the Long Pond in Bridgton. On the easterly side of the pond, about midway, is a cove, which extends about one hundred rods farther east than the general course of the shore—the bottom and the water so shoal, that a man may wade fifty rods into the pond. On the bottom of this cove are stones of various sizes, which, it is evident from visible circumstances, have an annual motion towards the shore. The proof of this is, the mark or tracks left behind them, and the bodies of clay driven up before them. Some of these are perhaps two or three tons weight, and have left a track several rods behind them, having at least a common cart-load of clay before them. These stones are many of them covered with water at all seasons of the year. The shore of this cove is lined with these stones three feet deep, which, it would seem, have crawled out of the water.

This may afford matter of speculation to the natural philosopher.'

"Until I saw this paragraph, I did not imagine that a story, such as I received at Salisbury, would ever be repeated."—Vol. III. p. 245.

Upon the preceding statement the Quarterly Review remarks:—

"Dr. Dwight has not stated the size of the rock which is said to possess this extraordinary power of locomotion; if he had, it is possible that a story which, in another of his journals, he relates of the Oneidas, might explain the apparent prodigy. Those Indians regard a large stone with religious reverence, and speak of it as their god, because it has followed them in their various removals, slowly indeed; but to a considerable distance. The truth is, a stout young man resolved to amuse himself with the credulity of his tribesmen, and therefore, whenever he passed that way, took up the stone, which was too large to be removed by a man of ordinary strength, and carried it some distance westward. In this manner, the stone, advancing by little and little, made in a few years a considerable progress, and was verily believed to have moved this distance spontaneously. The young fellow told the story to an American gentleman, and laughed heartily at the credulity of his countrymen. But had the rock which Dr. Dwight saw been of dimensions which would render a trick like this possible, he would surely have suspected it; it is highly improbable that the same strange and troublesome deception should be attempted in two places; and in the statement quoted from the Massachusetts Transactions, some of the stones are said to be of two or three tons weight. That statement appears to have been reprinted from a Portland newspaper, the place where the phenomenon is said to exist being only eighteen miles from Portland. Any thing, therefore, which might be so easily contradicted or disproved, would hardly have been published, unless it had been commonly believed. But if science and literature are making such progress in this part of the United States as some suppose, the matter will doubtless be investigated as it deserves, and the truth or falsehood ascertained of statements apparently so impossible."

The Rev. J. Adams, a correspondent in Professor Silliman's Journal, gives the following explanation of those phenomena:—

"The cause to which I am inclined to attribute them, and which appears to me satisfactory, is, *the operation of the ice.* The manner in which the effect is produced, I conceive to be this:—The ice forms firmly about the rock, and as it expands from the middle of the pond towards the shore, carries the rock along with it. The fact, that the ice does expand from the middle towards the borders, in all cases where water is frozen, must be evident to all acquainted with cold climates, and who have observed the circumstances in which ice is formed. When water is left to be frozen in a vessel, the expansion from the middle to the outside is so strong as to break the vessel. This is sometimes the case even where the vessel is of iron. There is often, also, a considerable elevation in the middle of the ice, resulting from the resistance of the sides of the vessel to the outward expansion; but in ponds and lakes this central elevation is never formed, on account of the immense weight of the ice,* and the little or no

* The expansion of ice, though so great a force, that no known resistance can confine it, is always exerted in the direction where there is least resistance. I several times repeated the following experiment before my classes, while Professor of Mathematics at the University in Rhode Island. I procured a military shell, weighing 70 or 80 pounds, and capable of containing nearly two quarts of water. The orifice was about an inch in diameter. At the approach of a very cold night, I filled it with water, and placed it in a situation favourable for freezing. In the morning, all the water was frozen, and a column of ice was driven through the orifice, of the diameter of the orifice, rough in appearance, and five or six inches long. When water freezes in a vessel of some strength, at first the resistance of the sides causes the elevation of the ice adverted to above. As, however, the ice continues to thicken, and to oppose a resistance continually increasing to the expansion upwards, a time arrives at length, when the sides of the vessel present a less resistance to the expansion, than the super-imposed ice, and at this point the vessel is broken. But when ice forms upon a lake, this elevation cannot take place, on account of the *very great weight* of the whole mass of ice, which *weight*, in ordinary circumstances, prevents the expansion upwards. Its expansion below into the general mass of the water is hindered by the water being confined *on all sides*, and thus opposing a resistance scarcely less than that of a solid body. The expansion, therefore, will naturally be directed towards the shore, and a disruption between the main body of the ice and the shore will be made, where the shore is inclined at a moderate angle to the surface of the water, and a projection of the ice will take place. This pro-

resistance to the outward expansion on its borders. When an egg is frozen, it bursts from the same cause, with a wide fissure. The same is true of trees, which in very severe weather sometimes burst with a loud report. Again, I have observed, that in large ponds and lakes, where thick ice has been formed, a disruption, just at the edge, between the main body of the ice and the shore, has taken place, and that the ice has projected upon the shore a considerable distance over the line of disruption. In case this ice had formed upon a rock near the shore, the rock must have been carried with it in its expansion towards the shore, and must have been left in that situation at the melting of the ice. When the ice formed again, it would be carried further forward, and since in New England the ice forms and melts often several times in succession during a single winter, it is easy to see that in several years a rock might make very perceptible progress. I have also noticed, that, in New England, fences which originally stood erect, near the edge of the grounds, covered by water during the winter, have considerably inclined towards the shore as soon as the ice was formed, and fences in this situation always require to be placed upright in the spring. It is well known among the farmers of New England, that, if a stone fence is erected in a similar situation, it will, after some time, be overturned. These instances show both the reality and great force of expanding ice. It is no objection to this explanation, that the principal rock which Dr. Dwight saw, was originally, according to the testimony, two feet at least under the surface of the water, because in New England the ice sometimes forms three feet in thickness, which would be sufficient to form about this rock, and also, for aught that appears to the contrary, about those mentioned in the Massachusetts Transactions. The firmness with which ice attaches itself to rocks, may be estimated from the circumstance, that those of many tons weight are sometimes raised from the beds of rivers, where the ice reaches to the bottom, and carried imbedded in the ice to a great distance.

jection must have often been seen, by every one accustomed to cold climates, when thick ice is melting, as it frequently lies several feet beyond the edge of the water; and if the fracture of this ice be examined, the appearance indicates that the lower part of the formation has been *forced* outwards.

"Whenever the shore is perpendicular to the water, or approaching to it, this projection cannot take place in any considerable degree, and in such circumstances I have seen the ice cracked in many places, and numerous planes joined at the crack, elevated so as to be gently inclined to each other, like a very flat roof. This was the natural effect on the mechanical principles which must govern the results. My views on this part of the subject are very much confirmed by the circumstances of the 'Deerfield disruption.' In this instance, 'the earth, to the depth it had frozen the past winter, 14 inches, was broken in a straight line above six rods, and the south edge of the fissure having been forced up, overlapped the other three feet.'"

"It appears also by the testimony, that the principal rock now moves much more rapidly than many years since, and this is what might have been expected, according to the explanation I have suggested. When the top was 'two feet at least' below the surface, only the thickest formations would reach it, and of course its progress would be very slow. When the top reached the surface, the thin formations would effect it, and when it rose above the surface, it would be grasped in the middle by every successive formation, and would be carried forward by the whole amount of the expansion.

"The circumstances of the channels behind the rocks, and the earth heaped up before them, render two things evident:—First, that each rock was always moved in a *position similar to itself*, without ever being turned over; for if the motion had been produced by repeatedly overturning the rocks, they would not have left channels behind them. And again, an immense force must have been exerted to remove these rocks, especially when we consider that one of them weighed, by estimation, 40 or 50 tons, and when we add to the resistance arising from its weight, that which must have been caused by the formation of a deep channel after it, The expansive power of ice is a force abundantly sufficient."

PRACTICAL RULES FOR CALCULATING THE LENGTHS OF PENDULUMS.

SIR,—If you think the following practical rules for calculating the lengths of pendulums, &c. would be useful to any of your readers, I shall be obliged by your giving them a place in your very valuable Magazine.

1st. To find the length of a pendulum that shall make any number of vibrations in a given time, as one minute.

Now, it is demonstrated by writers on mechanics, that $n^2 : 60^2 :: 39.14 : L$;

therefore, by multiplying means and extremes, and dividing by n^2, we have $L = \frac{60^2 \times 39.14}{n^2}$, whence n = the number of vibrations made by a pendulum 39.14 inches in length in the latitude of London, and L equals the length.

EXAMPLE I.

What is the length of a pendulum that makes thirty-five vibrations in one minute?

Now the above expression becomes $L = \frac{60^2 \times 39.14}{35^2} = 115$ inches, the length required.

2nd. Having the length of a pendulum given, to find how many vibrations it will make in a minute.

From the above expression, viz. $L = \frac{60^2 \times 39.14}{n^2}$, we find $n = \sqrt{\frac{60^2 \times 39.14}{L}}$.

EXAMPLE II.

How many vibrations will a pendulum, 115 inches in length, make in one minute?

Now the above expression becomes $n = \sqrt{\frac{60^2 \times 39.14}{115}} = 35$, number of vibrations required.

3rd. Having the length of a pendulum vibrating seconds in any place given, to find the space through which a body falls in a second by the force of gravity.

Now it is demonstrated by mathematicians, that the space through which a heavy body falls by the force of gravity in the time of one vibration of a pendulum, is to half the length of a pendulum as the square of a circumference of a circle is to the square of its diameter, that is (denoting the space fallen through in a second at the given place by S, and the length of the pendulum by L) $S : \frac{1}{2} L :: 3.14159^2 : 1$; therefore $S = \frac{1}{2} L \times 3.14159^2$.

EXAMPLE III.

Through what space would a heavy body fall from each in one second of time, when a second pendulum is 39.14 inches in length?

Now $L = 39.14$, therefore $S = 19.57 \times 3.14159^2 = 193.14$ inches.

By the converse of this method we can find the length of a second pendulum, having the space fallen through by a heavy body from rest in the first second of time.

Take $S = \frac{L}{2} \times 3.14159^2$, and multiplying each side of the equation by 2, we have $2S = L \times 3.14159^2$; therefore $L = \frac{2S}{3.14159^2}$.

EXAMPLE IV.

What is the length of a second pendulum in the place where a heavy body falls, from quiescence, 193.14 inches in the first second of time?

Now $S = 193.14$ inches; therefore $L = \frac{2 \times 193.14}{3.14159^2} = 39.14$ inches, the length.

All the above examples are very readily solved by the sliding rule, as follows.—

EXAMPLES I. AND II.

C | 39.14 . . . . 115 inches.

D | 35 $\left\{ \begin{array}{c}\text{number of vibrations} \\ \text{per minute}\end{array} \right\}$ 60.

which, in words, is this :—Set the number of vibrations given on the line marked D to 39.14 on C, and against 60 on D you have the length of the pendulum on C; or set the length of the pendulum given on C to 60 on D, and opposite to 39.14 on C you have the number of vibrations per minute on D.

EXAMPLE III.

C | 19.57 . . . 193.14 inches, space fallen through in one second.

D | 1 . 14159.

EXAMPLE IV.

C	386.28	. . . 39.14 inches, length of pendulum.
D	3.14159	. . . 1.

I am, Sir, your most obedient servant,

Bulbourne. WILLIAM LAKE.

COMPRESSIBILITY OF WATER.

This experiment has been tried by the distinguished Danish philosopher Œrsted, by an ingenious apparatus of his own invention. The result is thus stated :—

"Agreeably to the mean of a great number of experiments, a pressure equal to that of the atmosphere produces in water a diminution of volume of 0.000045. In all the trials with my apparatus, from the pressure of one-third to that of six atmospheres, I have the compression of water to be in the ratio of the compressing force. Canton had obtained, in the greater number of his experiments, 0.000044 for a pressure equal to that of the atmosphere, which differs only one millionth from my result. The ingenious experiments of Mr. Perkins, made with several hundred atmospheres, give 0.000048 for each atmosphere. I am induced to attribute this difference, in itself very small, to a compression which the sides of his vessel (being of metal) may have sustained. Another circumstance ought, perhaps, also to be taken into consideration, viz. that water seems to lose a little of its compressibility after several compressions. I dare not, however, aver this to be the fact, not having subjected it to a rigorous trial."

ART OF BAKING.

A machine for accelerating the fermentation of flour has been invented at Lausanne, in Switzerland. It consists, simply, of a round box of pine-wood, a foot in diameter, and two feet long, placed upon gudgeons, and put into motion by a handle or winch, resembling exactly the cylinder used for burning coffee. An opening is made on one side for receiving the dough. The time necessary for fermentation depends on the temperature, the rapidity of its motion, and many other circumstances; but, when the paste is properly raised, the operator discovers it by the hissing sound of the fixed air, as it rushes out of the machine. It never fails to work well, and requires, at most, half an hour's attention. The labour is nothing, as a child can turn the machine. If made longer, and divided into compartments, it would serve for the preparation of several kinds of paste at the same time. This machine offers the double advantage of raising paste expeditiously and to the exact degree required.

INK.

The bark of the chesnut (*Fagus castanea*) is said to contain twice as much tan as that of the oak, and gives, with sulphate of iron, a beautifully black ink. The colour which this tan produces is less liable to change by the sun and rain than that produced by sumac.

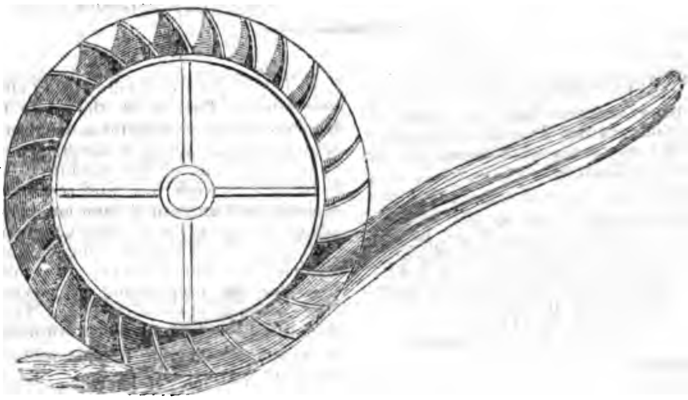
SYPHON.

An improvement on this instrument has been made in Paris by M. Buntem, instrument-maker, 26, Quai Pelletier, so as to save the necessity of suction. Near the top of the outer and longer branch, just below the bend of the syphon, a ball is blown, forming part of the stem itself, and of a suitable size. On filling this branch (together with the ball) with a fluid, stopping the end of the tube with the finger, and then immersing the short leg in the liquor to be drawn off, the operation will go on at pleasure.

The same artisan has improved the common or domestic barometer, so as to prevent the possibility of air getting into the tube by a variation of its position.

INQUIRIES.

NO. 132.—WATER-WHEELS.



SIR,—In Number 69 of the Mechanics' Magazine, a Water-wheel is mentioned to be required for a weak stream, the whole fall being 13 feet. Now, I shall be glad if any of your readers will recommend, through the medium of your Magazine, a Water-wheel for a weak stream, the fall not being capable of being made above 11 feet. Mr. Lambert has laid it down, that a *breast-wheel* should be used when the fall of water is above four feet in height, and below ten.* What kind of wheel will be best suited to a weak stream where the fall may be made 11 feet? Can any of your readers recommend any thing preferable to a breast-wheel, of the above form and the following dimensions:—

Radius of the wheel from the extremity of the float-boards, 7.52 feet.

Breadth of the float-boards, 1.71 feet.

The float-boards to be confined, both at their sides and extremities, so that the water may accompany them to the lowest part of the wheel; the float-boards to incline to the radius of the wheel, so that each float-board, when lowest, shall not be vertical, but have its edge turned up the stream about 20 degrees.

G. B. K.

* See Nouv. Mem. de l'Académie de Berlin, 1775, p. 71.

NO. 133.

CONSTRUCTION OF BEE-HIVES.

SIR,—Through the medium of your valuable Magazine, allow me to inquire of your Apiarian Readers, the best mode of constructing, arranging, and sheltering Flat Hives; and also the most proper time for extracting their delicious contents.

During the last three years, I have kept bees, with varied success, in boxes with glass fronts, in the window of a south room of my house; but as all the space proper for their establishment within doors is occupied, I placed one swarm, of prodigious size, in *flat* hives in my garden, on the 21st ult., in preference to the dome-topped hive, so well known to most of your readers; and my principal motive in doing it is, that I shall be enabled (as I am informed) to take away a portion of their honey (say that contained in the upper hive, if not that in the next also), without destroying its industrious inhabitants. The conical hats or hackles, usually placed on hives for the purpose of sheltering them from the weather, are commonly, in this neighbourhood, made of reed or straw, of a length insufficient to cover more than two or three of such hives, each about six inches deep, and twelve inches in diameter. How is this defect best remedied?

Possibly, some of your numerous Correspondents may also be enabled to afford information relative to the construction, cost, situation, productiveness, &c. of the Leaf or Book Hive, invented by the indefatigable Huber.

It is to be regretted, that the culture of so prolific and industrious an insect as the bee, is not more attended to in a

country so highly cultivated as England, where the greatest variety of flowers presents themselves to its taste, when collecting those sweets which produce honey equal to that of any part of the world, more particularly when we take into consideration the great amount paid every year to foreigners for this article of commerce.

Straw hives, of either make, are within the reach of every frugal cottager, whether artisan or husbandman, who, whilst pursuing his daily labour, has (generally speaking) a wife or children at home, capable of securing the swarm or swarms which every stock of bees may be expected to throw off.

Thus their more extended cultivation might be made a source of *individual* profit, and, at the same time, by employing the resources with which an all-bountiful Being has blessed us, contribute, collectively, to an increase of the happiness and prosperity of

"THE LAND WE LIVE IN."

Burton.

ANSWER TO INQUIRY.

NO. 119, VOL. IV. P. 64.

SIR,—On looking over some Numbers of your Publication, I found it asked, why the force communicated by the rod from the beam was greater when the rod was eight feet long, than when only five feet long? If we resolve the force which is communicated in the direction of the rod into two parts, one in the direction of the crank, the other perpendicular to that direction, the part which is perpendicular to the crank is alone productive of rotation. Now I think that the mean inclination of the rod to the crank is more nearly equal to a right angle when the rod is eight feet, than when only five feet. Hence the part of force which is productive of rotation is greater in the former case, and a greater effect will be produced.

I am, Sir, yours, &c.
M. O. E.

CORRESPONDENCE.

F. O. Z. will perceive, that he was anticipated by the article in our last Number on the line of draught in carriages. His conclusion is precisely similar:—"Hence it is plain," he says, "that great part of the leaders' force is actually employed in breaking the wheelers' back."

R. H.'s Plan for Measuring Heights was, from the first, intended for insertion, but the diagram accompanying it has been mislaid. If he will oblige us with another copy, the article shall appear forthwith.

T. M. B. will please send to our Publishers for a letter addressed to him.

We shall be glad to receive the farther communications of Mr. G. M. (Dublin), and Philo-Naut.

Communications received from—W. C——y.—A Mechanic—A Bookbinder—Mr. Lake—G. M. A.—J. Jay—S. W. T.—E. A.—J. T.—A Constant Reader—W.—F. R. A.—D. Thomas—S. G. R.—R. Crusoe—Telloc Trigger—A Visitor to our Atmosphere—A Reader, but no Philosopher—J. S.—D. C.—R. J.—Z.—A Promoter of Improvements—Aurum—Jo. Senhouse—An Old Mouse—A Manufacturer—A Mechanist—T. C.—Mr. Hayter—Mr. Dowden.

ERRATA.—Page 150, col. 2, line 15, for ",14 = 142*l.* 17*s.* 1¾*d.*" read, ",875 = 137*l.* 2*s.* 10½*d.*"—Line 16, for "142*l.* 17*s.* 1¾*d.*" read, "137*l.* 2*s.* 10½*d.*"

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Mechanics' Magazine,

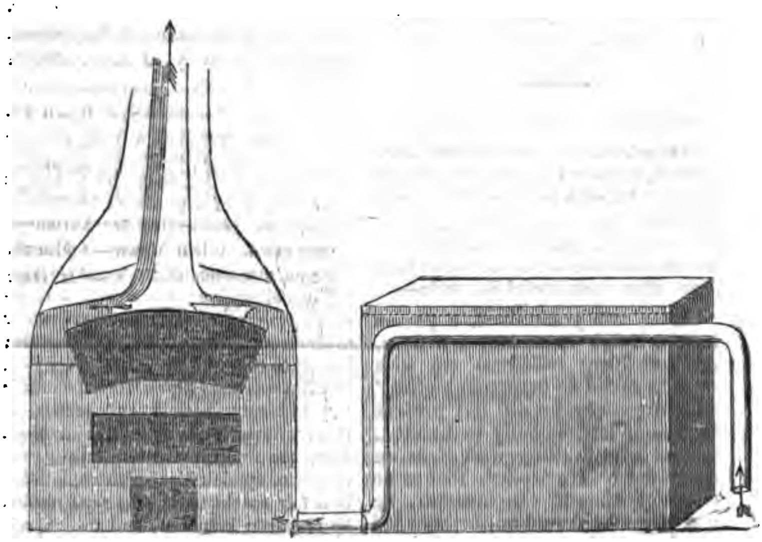
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 97.] SATURDAY, JULY 2, 1825. [Price 3d.

"The hand of Nature, on peculiar minds,
Imprints a different bias, and to each
Decrees its province in the common toil.
To some she taught the fabric of the Sphere,
The changeful Moon, the circuit of the Stars,
The Golden Zone of Heav'n; to some she gave
To weigh the movement of eternal things,
Of Time and Space, and Fate's unbroken chain,
And Will's quick impulse; others by the hand
She led o'er vales and mountains, to explore
What healing virtue swells the tender veins
Of herbs and flowers." *Akenside.*

PLAN OF HEATING AND COOLING LIQUIDS,

BY MR. H. C. JENNINGS.



O

PLAN OF HEATING AND COOLING LIQUIDS.

Sir,—If you think the enclosed plan of heating and cooling by the same fire will be useful to brewers, &c. you are welcome to the idea for the public service. I find it economical and perfect, and very cheap.

The furnace has an air-tight ash-hole door, and the thin metal pipes run through and under the surface of the liquid to be cooled. The fire, when once lighted, draws the cold atmosphere through the several pipes, and rapidly absorbs the caloric or heat in the fluid, while the water or wort, &c. in the boiler is gaining heat.

The whole arrangement is simple and cheap, saves time, and is rapid, in ratio with the rapidity of the combustion of the fuel.

I have tried several experiments, and find the cooling, with a good large fire, as one to eleven in comparison with the mere exposure of surface only, and in this case we gain even that value by placing the pipes three inches below the level of the surface.

I am, Sir,

Your obedient servant,

H. C. Jennings.

Devonshire-street, Portland-place.

SPENCE'S PERPETUAL MOTION.

Sir,—Your Correspondent, Mr. T. Bell, in page 119, vol. iv., having expressed a wish to know the fate of Mr. John Spence, of Linlithgow, or his invention, you will much oblige me by the insertion of the following account in your useful journal:—

About two years since, a person named Haigh (a native, I believe, of Yorkshire) called on me with what he called a 'perpetual motion.' I inquired why he did not present it to some learned body in London, instead of travelling with it as an exhibition? He replied, that as he was not himself the inventor, he was afraid he should not be attended to: he said it was invented by the late Mr. John Spence, of Linlithgow, near Edinburgh, who, being on his journey to London to present it to the Royal Society, was taken ill in some part of Yorkshire, where, after a lingering illness, he died, and that he bequeathed the machine to him in gratitude for the assistance he had received from him during his illness. The construction of the machine was as pointed out by Mr. Bell, with this difference: the needle was attached to a brass balance, about the size and weight of the balance of a watch, beyond the edge of which it projected. He suffered me, after having witnessed its swift rotatory motion for about half an hour, to remove the balance, &c. from the frame in which it acted, when I found the pivots and holes very much worn, which convinced me it must have been in action a considerable time (he said it had, nearly six years). On replacing it, and blowing slightly against the edge of the balance, it instantly commenced its action as before, *i.e.* with the same steady velocity, making about 160 revolutions in a minute, which I again witnessed a considerable time, nor did Haigh appear the least impatient to put an end to the gratification I was experiencing.

The following extract of a letter from Capt. Bagnold, R. M., Member of the Society of Arts, Haigh left with me:—

"Liverpool, May 2, 1820.

"Having inspected Mr. S. Haigh's exhibition of a magnetic perpetual motion, I prevailed upon him to permit the approach of a powerful horse-shoe magnet, the property of Mr. Byewater, of this town. When in contact with the glass on one side, it produced no very striking alteration; when held perpendicularly over the case, it appeared rather to accelerate the revolution of the needle; but when removed to the opposite side, its effect was instantly visible—the needle was suddenly checked, and seemed to recover its motion by successive impulses. From the foregoing circumstances I am clearly of opinion Mr. Haigh's exhibition is a fair specimen of perpetual motion by magnetic influence, and the experiment has totally banished from my mind

all suspicion of deception; and I strongly recommend Mr. Haigh by no means to repeat the experiment, lest injury should accrue to so an ingenious an invention."

Fearing I have spun out my communication to an inconvenient length, I hasten to a conclusion, and remain,

Sir,

Your constant reader,

Richard Price,

Watchmaker and Silversmith.

Wiveliscombe, Somerset,
June 13th, 1825.

PROPELLING VESSELS BY HORIZONTAL STROKE.

Sir,—On perusing the Mechanics' Magazine of the 18th instant, I observed an article on the direct effects of the Paddle-wheel of Vessels propelled by Steam, and of one by a Mr. Vallence. In the first place, I must observe, in respect of your Correspondent, J. Hare, that it is not a new idea to propel vessels by steam, or a horizontal stroke. My Lord Stanhope, of philosophic and mechanic notoriety, had a vessel built on purpose, in the Thames, about 35 years ago, into which he put an engine of great power. It was brought to act on machinery which produced a horizontal stroke, closed, and returned by the side of the vessel; but the reaction was found to be so great, that the impulse produced on his vessel, *a flat-bottomed one*, did not exceed three miles per hour. His Lordship had a hint at the time, that a rotatory motion would answer the desired purpose.

Further, I beg to inform your Correspondents, that a person of the name of Hawkins (who took out a patent, about three years since, for a method of constructing a tunnel under the Thames), showed me a working model, for a motion to be applied to the shaft or axle of any engine which makes an elliptical stroke, fore and aft, nearly, in which the whole of the paddles act with surprising velocity, and clear of every reaction against the water, and "feather," as your Correspondent expresses it, avoiding thereby the effect of the wind.

I am, Sir,

Your humble servant,

J— M—.

Rotherhithe, 20th June, 1825.

N.B. I think Mr. Hawkins's model for propelling, in the manner as described, has been made above two years.

CLIMBING BOYS—NEW MACHINE.

In the hope of contributing a mite towards supplying the want of entirely-appropriate machinery for sweeping chimneys, a writer in the *Newcastle Chronicle* suggests the use of the following instrument:—Let a very light, but firm, chain be passed from the bottom of the chimney to the top (through a pulley at every considerable angle or bend), returned loose to the bottom, and hooked to the other extremity, leaving four or six spare feet of chain to be fastened up within the chimney when not wanted. A continuous ellipsis of chain would thus be found within the extremities of the chimney, one-half of it being loose. By a simple contrivance, a brush, of a more considerable size than to fill the capacity of the flue, may at any moment be affixed to it, and closing up the fire-place with a cloth, having two minute openings through it for the arms, the brush may be worked so as thoroughly to cleanse the chimney through its whole extent. In case of fire in the flue, a valuable instrument for extinguishing it, it is evident, would be found in this chain, by drawing up, through means of it, a bundle of wet cloths, instead of sending up a poor child, clothed in a dress steeped in cold water, as is too frequently done. The original cost of the article would not be considerable, and in a small number of years it would repay itself. The writer has the satisfaction of knowing that the suggestion has received the decided approbation of several persons of practical skill and science.

A. Z.

BADNALL'S PATENT MACHINE FOR THE MANUFACTURE OF ORGANZINE.

Sir,—Happening to visit a friend of mine, who has recently embarked in the silk business, I was very much struck with the clumsy and inferior manner in which the machinery was made, and at the slow progress by which the silk was thrown, which, I presumed, was owing to the number of stages it had to go through. My surprise was much heightened, when my friend informed me he had spared no expense, but that he had

adopted *the best and most approved machines*. I remembered having seen several advertisements of my neighbour, Mr. Badnall's Patent Machine, with a reward offered, as though he had some apprehension of its being pirated, and I have no doubt but he has good grounds to dread such a thing, or he would not put himself to so much expense to make people suspect that he had suspicion. Well, Sir, I remembered these advertisements, and also recollected a letter of his, describing the merits and advantages of his patent machine, in your valuable and very useful Magazine (No. 75, page 291), and not in the least doubting but every word was truth, I sought the letter out for my friend's inspection, fully satisfied that I was letting him into a secret that would be of the greatest advantage to him; but on his consulting with several experienced throwsters, guess my surprise at hearing them declare, that Badnall's patent machine did not answer the description given of it by him, and that the statement made, that it would save 30 per cent., is not correct. On inquiring farther into the business, I learned that it is generally understood, that the very best improved organzine spindles (patent or not) at present in use, will not give an average revolution of more than 500 turns a minute; yet I see, in the letter I allude to, that Mr. Badnall states, that he has one mill working at the rate of 4000 turns a minute. I do not know how to reconcile these two assertions, made by two respectable tradesmen, living near and known to each other. I somehow think Mr. Badnall must be mistaken in his statement, particularly as I find, on inquiring fully into the matter, that his spindles propel each other by means of toothed wheels. Two wheels of 25 teeth each, *at least*, receive this motion from one of 40 or 45, according to the kind of work; therefore, if these two wheels, of 25 teeth each, revolve 4000 times a minute, each spindle must run over the immense number of 100,000 teeth in that short space of time; and I should think that, as these three wheels are in close connexion, each organzined thread will have to support the jar produced by the extraordinary rapidity required for 300,000 teeth to pass each other in 60 seconds. This really does appear a little out of reason; and if the speed mentioned in Mr. B.'s letter is actually got, it must infallibly destroy the wheels in a very short time.

If this should meet the patentee's eye, and I hope his bookseller (who is, as he says, "a pretty regular sort of fellow") will not neglect to send this Number down, perhaps he will notice it; for he is more interested in this question than I am, as I dare say he knows that the general opinion of the trade is against his patent. Perhaps he will be good enough to say how he calculates the velocity of his spindles: but in case he should not like to notice this, perhaps some one of your numerous readers will take the trouble to say, what is the greatest velocity at which spindles are known to turn in silk, cotton, and worsted, and how the calculation is made; also, what is their opinion of the possibility of a spindle revolving 4000 times a minute, when it receives its motion by a wheel of 25 teeth, driven by one of 40, and carrying round with it a bobbin weighing three or four ounces.

I am, Sir, yours, &c.

A WEAVER.

Wood-street, Cheapside.

REV. EDWARD IRVING'S OPINION OF THE EDUCATION OF THE MECHANIC CLASSES.

[We extract the following very pertinent observations on this subject from a Report, which appears in *The Pulpit*, of a Sermon preached by Mr. Irving for the benefit of the Society (in Scotland) for Propogating Christian Knowledge in the Highlands and Islands.—ED.]

"There is no subject at present so prominent to the public eye, or which engages so much the care of the religious world, as the education of the people. It hath prospered to a degree heretofore unexampled; insomuch that those who were formerly opposed to it, are silent, or disposed to adopt that to which they once objected. Among the many inventions of this kind which have been patronized, there are especially two—schools for infants, and schools for mechanics, which have arisen as by enchantment, and spread themselves over the land. And, as the effect of these institutions, there have sprung up, like summer fruits, and been scattered, like autumn leaves, works for the infant mind, introductory to history, literature, and general knowledge; and periodical works have been multiplied an hundred-fold, and newspapers a thousand-fold, within the last century. All this testifies with one voice the capacity of man for knowlege, and shows to what extent that knowledge may be multiplied, fulfilling the prophecy of Daniel, 'Many shall run to and fro, and knowledge shall be increased.'

* * * * * * * *

"Now, as *letters* are the means of revealing knowledge to man, and as God has been pleased to employ them in

making a revelation of his will to man, *reading* is the means to be employed to acquire this knowledge. Next, that a man may be able not only to profit from the past, but also profit those who are to come; that each man may record his own views and feelings, and communicate them where or to whom he pleases; there ought to be added the faculty of recording his own thoughts and observations, namely, that of *writing*. These are *universals;* these ought to be taught every man; from these all may derive much guidance and consolation through life, and it seems to me that of this guidance and consolation the *poor* have the most need. Their life is a scene of burden and incessant toil; they have much to depress them to the earth, and little to elevate them; they have no facility, like the rich, to move to and fro, and behold the various works of Nature and of Art, and to make those discoveries which are calculated to lift up the head of man. I say, the *poor*, who are bound to a given place—who have no history, but a few tradititions—who have no wisdom, but in a few proverbs—who have no hope for age, but an almshouse; these have *the best right*, by having *the greatest need*, to reading and writing, those wittiest helps of invention, by which the past and the future are made to appear before the eye—by which the learned are brought down to the lowest capacity—by which the good are introduced to the fireside—by which the godly are made on a level with their quality—by which all that is great is made as free and blessed to the *cottage*, as it is to the palace or university. I would have it cried from the northern to the southern pole—from the rising to the setting sun, in language far less improperly accommodated than it is very frequently—' Ho, every one that thirsteth, come ye to these waters; and he that hath no money, let him come and obtain these gifts of reading and writing, without money and without price.' "

SAFETY OF THE MAILS.

The American Congress have passed a resolution for the adoption of a plan for the better securing of the letter-mails, submitted by an ingenious individual named Imlay. The Editor of the "*Washington Gazette*" states his belief, from actual inspection, "that Imlay has completely succeeded in producing a strong iron case, with a spring-lock, that will, in future, bid defiance to robbers." He has also effected an improvement in respect to the mail-coaches and waggons themselves, of which we have the following brief description :—

1. Mail Coaches.

The body is calculated to secure the driver from the weather perfectly; his seat is thrown back two feet; the front of the body is within the end of the sills, instead of projecting forward in the usual manner; a neat roof, with lamps and curtains of leather; also a large boot or apron to protect the driver, with side boxes for way-bills, arms, &c. leaving a large birth for mail bags under the driver, secure from storms or injury. Behind baggage is secured by a new method, under lock and key, perfectly dry; within the body is placed the iron cases for securing the letter mails. The cases are composed of wrought iron, made in a superior manner, with locks and hinges of great strength; the cases are bolted fast to the body. If necessary, the body will contain two cases, each holding three bushels of letters. Within the iron cases are placed portable copper or leather cases to contain the letters, all with inside locks. The body of the chariot is calculated to hold six passengers, and the cases are not the least in the way. The body is equal, if not superior, in point of room and convenience, to any, for the conveyance of passengers and mails, ever used in this country, and for summer or winter, perfectly calculated for heat or cold, having blinds with curtains and glasses. A new and much improved method for raising or lowering the body, and tightening the braces, called a rolling-jack, which removes the great difficulty of taking up the braces of stages, particularly in winter. A great improvement in the boxes and axles for carriages of this description, by which the friction is much reduced, and they run a greater distance without greasing, and require but little attention, consists in a thorough box, plated with steel at each end, and steel plates on the arm of the axle, each fitted in the most perfect manner, with a feeder in the centre for oil or grease.

2. Mail Waggon.

The Mail Waggon is on an entirely new plan, and is calculated to secure the mail in the same way as the chariot, having the same description of cases, and the mails perfectly secure from storms; made in every respect strong and substantial, at the same time not too heavy, and can be drawn in most roads by two horses. The waggons are calculated to hold the largest mails; the body is placed on springs, with braces to prevent the injury so common to papers and letters, owing to transporting them in waggons on the axle without springs.

The driver is secure from storms; and, in consequence of his being thus protected, can drive any distance necessary for one person to drive—say fifty or more miles.

BELL'S MARINE CRAVATS.

Sir,—I am convinced that my namesake and former acquaintance, Mr. Thomas Hindmarsh Bell, is, like the renowned Marquess of Worcester, actuated by too honourable motives to *knowingly* "put down other men's inventions, without nominating likewise the inventor;" he will therefore not be displeased to learn that his Marine Cravat is only another name for "Scheffer's Life-Preserver," the utility of which was so well exemplified by the ingenious inventor last year in the Thames, and witnessed by thousands of admiring spectators. Mr. Scheffer's contrivance does not depend on cork for its buoyancy, being composed of skins without seam, and perfectly air and water tight; it is, when wanted for use, instantly inflated by blowing into a small aperture left for that purpose, and furnished with a stopcock to prevent the egress of the air. This apparatus is of signal service to persons learning to swim, and would, if generally adopted, prevent those painful accidents so prevalent in the bathing season, particularly in the vicinity of the metropolis. It is a common practice for the young swimmer to throw himself upon the cord connecting two pieces of cork-wood; but this is a plan replete with danger, as, in case the float passes down towards the feet, that part of the body will be kept at the surface of the water, whilst the head will descend. I have known two or three valuable lives lost in this manner.

I am, Sir, yours heartily,

Teasdale Bell.

2, Commercial-road, Whitechapel,
June 20, 1825.

CAPTAIN MANBY'S FIRE-ENGINES.

Sir,—As your Correspondent from Newcastle, under the signature of J. H. Z., requests to be informed "where the engines or vessels for the *speedy extinction of fire*, described in the 58th Number of the 'Mechanics' Magazine,' may be had, and the price of them; also of the condensing syringe, from an opinion they may be of infinite service;" I beg leave, in reply, to say, that the person who made them for me, and to whom I paid 20*l*. for the set, is not now in the kingdom: but, as many improvements were found necessary while constructing them, such alterations consequently increased the expense; I therefore have no doubt but they now may be perfected much under that sum.

My object in producing the *Fire Cart*, containing apparatus for the speedy extinction of fire, is thus stated by me to a Select Committee of the House of Commons:—"To avert the dreadful calamity arising from fires in London, from a persuasion that the day will arrive, perhaps when I am no more, that a prompt method to check the progress of the flames for the preservation of life and property, will be hailed as important from motives of humanity and policy." Under this conviction, and, as I never had in view the desire to derive benefit from this or any of my productions, the public are at full liberty not only to apply them, but to make any or all for sale for their own advantage.

I must avail myself of this occasion to call the attention of the public to the evidence of the late Mr. Fielding, one of the Magistrates of Queen Square Police Office (a copy of which is herewith enclosed), on the subject of a fire-patrol in London and in all large towns. With that most intelligent gentleman I had many conferences, and felt, with him, that a well-organized fire-police would be of the greatest imaginable good. To adduce proofs that some more effectual protection to life and property, from fire, is required than is at present in use, I shall not deem it necessary, in confirmation of the present insufficient system,

to expatiate at large on the melancholy and destructive consequences attending it; because, scarcely does a week transpire without presenting to our immediate notice some additional case of distress to excite our commiseration, and demand our best efforts to prevent the recurrence of such calamities.

I cannot conclude without saying the public have a right to expect better protection from the Insurance Companies than is at present given. The expense attending the furnishing of *Fire Carts* for London, I should imagine would not exceed 5000*l.*, that is for 250 sets, to be placed as described by me in the 58th Number of your work, under the superintendence of the fire-police, arranged according to Mr. Fielding's plan.

I am, Sir,

Your humble servant,

George W. Manby.

Royal Barracks, Yarmouth,
June 21st, 1825.

Extract from Mr. Fielding's Evidence.

"Has any plan ever suggested itself to your mind, of establishing a better system of preventive Police, than what at present exists, independent of the one which you have mentioned, namely, a Superintendent Constable in each parish?

"Principally my thoughts have been turned upon the efficience of such a superintendent character forming the most beneficial preventive imaginable of crimes, at once simple and most powerful. May I take the liberty of suggesting another thing, which I communicated to Mr. Perceval very shortly before his death; I likewise did so to a Captain Manby, who has been much noticed for his mathematical exertions, desiring him to make use of the idea, or avail himself of it as his own. The suggestion was this: There are upwards of fifteen insurance offices against fires in London; I suggested, that if two firemen from every one of those insurance offices were to traverse up and down the streets of the metropolis every night, they would cross one another often and often. Let every man be provided with his axe and his link or flambeau; then this would be such effective means of security from fire, that the public would be highly pleased with such an establishment. It would be equally beneficial to the offices themselves, for it would be a vast provision against the accidents of fire; for these men, upon the discovery of a fire, might proceed with their axes, and with their lights, into the houses where the accident occurred. Another thing I shall take the liberty of suggesting, is, that these two men, in their walks about the town, should have, under the authority of the Magistrates in the different districts, the office or power of constables."

EGYPTIAN ORE.

Sir,—In your 91st Number, page 111, your Correspondent 'Quibus' wishes to know whether the metal manufactured into various articles and sold by Mr. M'Phail, under the name of Egyptian Ore, answers the description given of it by the inventor. I can assure him that it does not, as I will prove. Having heard of the excellent seals which were made of this metal, I was induced to purchase a small one for trial, for which I paid 7*s.*, which, certainly, for five or six days, had every appearance of fine gold; at the expiration of which time it began to change colour, and finally put on the appearance of common brass.

If, through the insertion of the above, I may be the means of preventing your Correspondent from being deceived, I shall be much gratified.

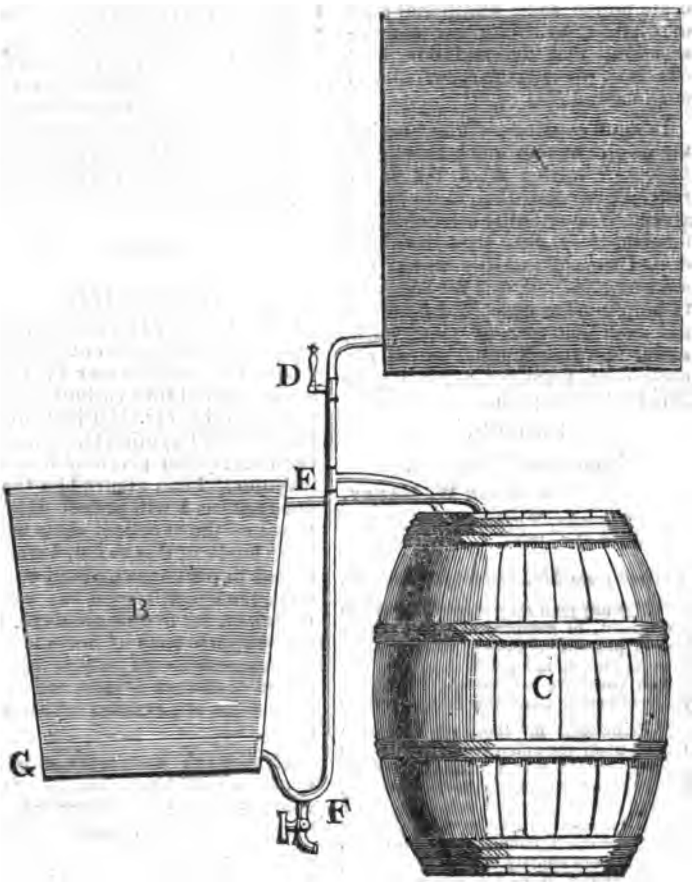
I am, Sir, yours truly,

R. Farley.

P.S.—I have enclosed the seal above alluded to, in order that you may pass your own opinion upon it.

[It is exactly of the description given of it by our Correspondent.—Edit.]

IMPROVED FILTERING APPARATUS.



SIR,—I herewith send you a description of a Filtering Apparatus, which I tried for rain water for several years, and founu to answer extremely well. It has, I think, several advantages over the one described in No. 22, page 21, and is as complete, perhaps, as can be made. The name of the inventor I do not recollect.

Description.

A, the vessel containing the unfiltered water.

B, the filtering vessel.

C, the vessel to contain the filtered water.

A leaden pipe, of small bore, communicates from A to B, in the manner represented in the drawing, in which, at D, is a cock, to regulate the quantity of water passing through it in a given time. By having the handle of this cock a lever, six inches or a foot long, and the end which is farthest from the cock terminating in a point, and a scale fixed behind it, to show how far it is turned, the rate of filtration may be regulated with great exactness.

E is a ball-cock fitted in the pipe, the ball of which being in C, stops the process when C is filled.

F is a cock, which will draw water from this pipe.

G is a false bottom, filled with holes, and fixed in B, a few inches from the bottom, immediately above the entrance of the pipe communicating with A. From the top of B, a small pipe conveys to C the filtered water. On the false bottom, G, are several strata of *clean* washed gravel, the coarsest at the bottom, and the finest at the top; the whole occupying, perhaps, one-third of the space between G and the pipe at the top. On the top of the gravel is a piece of strong flannel, secured by nails to the sides of the tub, and the tub is filled to within two inches of the pipe with fine *clean* washed sand, or, if it be preferred, for the sake of sweetening the water, as well as clearing it, with sand and charcoal, in separate layers; taking care that the uppermost is of sand, and that another piece of flannel is placed on the surface of the charcoal, the more effectually to secure it from rising, in consequence of its lightness. B should have a loose cover, to keep out the dust, &c. I had one for C also, with an aperture for the ball-cock to work.

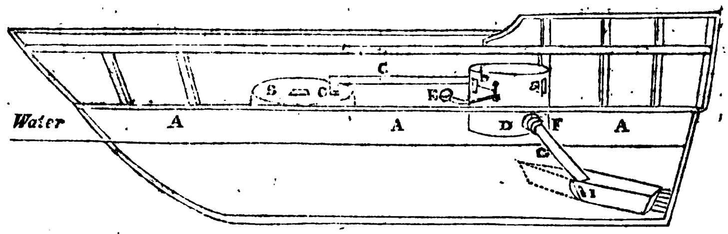
The principal advantage of this apparatus over the one before-mentioned, as described in your work, is, that by stopping the cock D, and opening F, and thereby changing the direction of the water in B, the sand and gravel are easily and effectually cleaned from the impurities they may have acquired. Another advantage is, that by the regulating cock, D, the rate of filtration cannot exceed any desired limit; whereas, by the other plan, the rate depends entirely on the quantity of filtered water drawn off for use.

I am, Sir, yours, &c.

J. S. M.

P.S. As some of your readers may not be aware of it, I may mention, for their information, that rain water is much better preserved sweet during the summer, by being kept in an underground reservoir, than when exposed to the variations of the temperature of night and day.

PLAN OF A STEAM VESSEL WITHOUT PADDLES, CYLINDER, PISTON, ETC.



Sir,—This figure is intended to show the probability of Steam Vessels being propelled without paddles, and the usual cumbrous machinery of cylinder, piston, &c. by the action of the steam, almost immediately against the resistance of the water, at any convenient depth. The part below the line AAA represents the lower outside part of the vessel; above that is the inside. B shows the upper part of the boiler, with the safety valve. CC, a pipe fixed over a hole in the top of the boiler to convey the steam into an air vessel, D, which has two valves opening inwards: one, *a*, to admit air after each stroke; the other, *b*, to receive the steam. The latter is to be kept shut by a bar fixed on a spindle turning inside, having one end coming through the air vessel, with a bent handle, having a ball, E, sufficiently heavy to keep the valve, *b*, shut, at any pressure the steam is to work at, yet so adjusted to that pressure, that a man may constantly open

and shut it, in order to work the vessel. At the bottom of the air vessel, D, are two pipes, passing through the sides of the vessel above water-level, one on each side, as at F; to these are joined the conducting pipes, G; through these pipes is conveyed the impulse of the steam into a trunk on each side, and as near as may be to the keel of the vessel; the mouths of these trunks may be of any form, and should make an angle of about 45° with the keel. A valve opens inwards at the highest end of the trunk, to let the water pass after each stroke; there is a valve also to keep the water below it, in order to gain all the resistance at once. The dotted lines show a piece of wood brought to an acute angle, to prevent the trunks checking the motion of the vessel.

Operation.

When the steam is produced in the boiler, B, by lifting the weighted ball, E, the steam will rush into the air vessel, D, and drive the air out of it (being heavier than steam) down through the pipe, G, into the trunks, one on each side the keel; there it will be resisted by the pressure of the water outside the trunks, and that resistance will be thrown against the valve, I, and thus propel the vessel. The continual opening and shutting the valve, *b*, in the air vessel, D, will cause a continual reaction of the water, which will open the valve, *a*, in D, and let in fresh air at each stroke, while the waste steam will escape through this valve, *a*. If there were no air vessel, D, the steam would probably be too soon condensed, by coming in contact with the water in the trunks, otherwise this were the better mode; and then a swing-plate, opening outwards at the mouth of the trunks, would close after each stroke, and a considerable suction would be felt at the valve, I, which would draw the vessel forward almost as much as the impulse of the steam would force her at each stroke, because then the air vessel being away, and the only valve, *b*, working in the steam pipe, the condensation of the steam in the trunks at each stroke would produce a vacuum in the steam pipe, which would be felt immediately by the valve, I, opening; and the vessel being drawn towards the front water in the same ratio as that water is drawn towards the trunks caused by the vacuum. There might be two trunks on each side the vessel, acting alternately.

The trunks may be made of strong oak; and suppose each of them to be three feet high by two feet and a half, and six feet below water-level on an average, I take the gross pressure at about 3 lbs. to each square inch of the mouth of the trunks.

Then, 3 feet, or 36 inches × 30 inches = 1080 inches × 3 lbs. = 3240 lbs.
There being one on each side, multiply by 2

6480 lbs.

Taking a horse power at 300 lbs. shows 21 horses' power of resistance at the mouths of the trunks employed to work the vessel. Experiment would best determine the length of the trunks; all I aim at here is to establish the principle, by which it does appear, that all the force of the steam may be employed without the intervention of a working cylinder, and its closely packed piston, with all the heavy, costly machinery of wheels, cranks, and paddles, and their unavoidable friction.

I observe the steam-vessels at Bristol have paddles five feet long by 18 inches deep in the water; that is, 60 inches × 18 inches = 1080 square inches; taking the *average* resistance of the water at 12 inches, or ½ lb. each inch, gives only 540 lbs. resistance, or 1080 lbs., there being one on each side of the vessel.

I am, Sir, yours, &c.

Z.

PATTERN-DRAWING CATERPILLARS.

A gentleman at Munich, named Hebenstreit, is said to have invented a process by which he makes a species of caterpillar spin a kind of wadding, which is of a fine white colour, and waterproof. He made a balloon of this stuff, and raised it, by means of a chafing dish with spirits of wine, in the large warehouse where he keeps his caterpillars at work. He makes them trace ciphers and figures in the wadding. He accomplishes this by moistening outlines of figures or letters with spirits of wine. The caterpillars avoid these tracings, and spin their web around them: thus any fine figure which has been drawn is represented in the stuff. A piece of wadding, seven feet square, perfectly pure, and as brilliant as taffeta, was made by about fifty caterpillars between the 5th and 26th of June.

WIDTH OF THE NEW LONDON BRIDGE.

Sir,—It may be thought presumptuous in an humble individual to make any remark on the judgment of the gentlemen managing the affairs of the New London Bridge; but if there is any thing wrong, or that can be improved, and there be yet time to make it right, it surely matters not from whom the suggestion proceeds.

Since this bridge has been so much spoken of, I have oftentimes ironically said, "Well, I hope we shall have a better passway than the present, otherwise we shall have the bridge down again." Now, from what I can make out from the plans which I have seen of this bridge, the footway will be but seven feet wide or thereabouts. I would ask if this is at all adequate to the increasing population that is likely to pass over it? In all probability, before this bridge is opened for passengers, there will be five or ten thousand additional persons who will have to pass over it daily. Look at the buildings now going on on the City lands on the Surrey side, as well as on the adjacent and distant country. At present a person engaged in business cannot get over the old bridge, during several hours in the day, in any reasonable time without *danger*, from being obliged to go into the carriage-way to pass some idler or slow timekeeper; and if the case is so now, what will it be if the population increases for another half-century?

I am, Sir,

Your obedient servant,

A Promoter of Improvements.

East-place, Lambeth,
13th June, 1825.

CUSTOMS CONSIDERED SUPERSTITIOUS ARE NOT ALWAYS SUCH.

Sir,—As nothing whatever can take place in the system but what is *natural*, the minutest and most familiar transaction is an object of scientific inquiry. It may likewise be asserted, that not only many of the customs of antiquity, which we are pleased to call superstitious, have rationality connected with their origin; but, even in the sciences, more correct ideas may have hitherto been maintained than the present modes of philosophizing among the *illuminati* permit us to appreciate. Under this impression I always feel happy to light upon the most ancient opinions to be met with on philosophical subjects, and, as respects modern discoveries, I find no ideas so correct as those formed at the time of discovery. Second editions leave many valuable circumstances omitted; and opinion formed on opinion (not upon the *minutiæ* attendant on experiment, which are parts of the fact, and wherein the truth is best discoverable) is substituted, until, at length, established opinion, in too many instances, has no better foundation than that of being the hypothesis of some professional dictator.

In no instance are these senti-

ments more manifestly true than the modern practice, in all introductory treatises, of taunting the ancients with their little knowledge in experimental philosophy, and their idle speculations after first principles. The fact however is, that notwithstanding the high value set on experimental proof, without some better knowledge of the acting power of nature than what modern philosophy hypothetically maintains, we may go on for ages *experimenting*, without forming any thing like a system to correspond with nature. It is general principles only, and not insulated cases, that can be said to agree with the system, wherein a few species of elementary matter, and unity of means of action, alone exist.

But to the point—It is considered nothing less than the result of low, vulgar superstition, the custom of applying the hand of a man, recently hung, to a wen. Whence the practice originated, or how it was performed, even tradition does not say; but that it might have been, in some degree, efficacious, and would be still, if scientifically pursued, I think is nothing unreasonable to conceive.

A wen does not consist of such morbid matter as not to depend for its existence and growth on organization and on circulation, and when we reflect on the very great ingress or egress of the ethereal fluids of a human body, suddenly deprived of life, and the possibility of a wen, brought in contact with the body, being acted similarly on, so as to promote circulation or destroy organization, there appears evidently more reason than superstition in the practice; at the same time, any other animal, under similar circumstances in all respects, would answer equally well. Failure of effect may, probably, arise from want of opportunity to make the application the instant vitality is subverted, and also from want of knowing that the parts brought in contact should have been previously made humid, or have a piece of linen between, moistened with some fluid, similar to that which promotes galvanic circulation.

Having been oftentimes edified by the "Mechanics' Magazine," I submit the above *pro bono publico*.

T———.

JOINTING STEAM-PIPES.

Sir,—Permit me, through the medium of the "Mechanics' Magazine," to return my thanks to Mr. Way, and your Correspondent at Bow, for their answers to my inquiry respecting the best method of making the joints of steam-pipes, at the same time to make a few remarks on the plans proposed.

With respect to Mr. Way's method of using Parker's cement for making the joints of water-pipes, it may answer the purpose very well; but that gentleman can have little idea of the power and effect of steam, if he thinks it would answer the same purpose for steam-pipes. I have no hesitation in saying, although I have not tried the experiment, that the joints would not stand good five minutes after the steam was turned into the pipes; for, as soon as the pipes become warm, they would expand, which would loosen the cement, and, of course, spoil the joint.

The method adopted with the pipes I made the inquiry about, was the one proposed by your Bow Correspondent; for, previous to receiving his information, the iron cement was made as he has directed, with the addition of a little dried clay, pounded and sifted, and mixed with the other ingredients, which is considered to bind them together better. Between the ends of the pipes was put an iron ring, about 3-8ths of an inch thick, and of the same diameter as the pipes; the two ends were then screwed firmly together, and the space between the flanches caused by the ring was filled up with iron cement, and well rammed with a caulking,

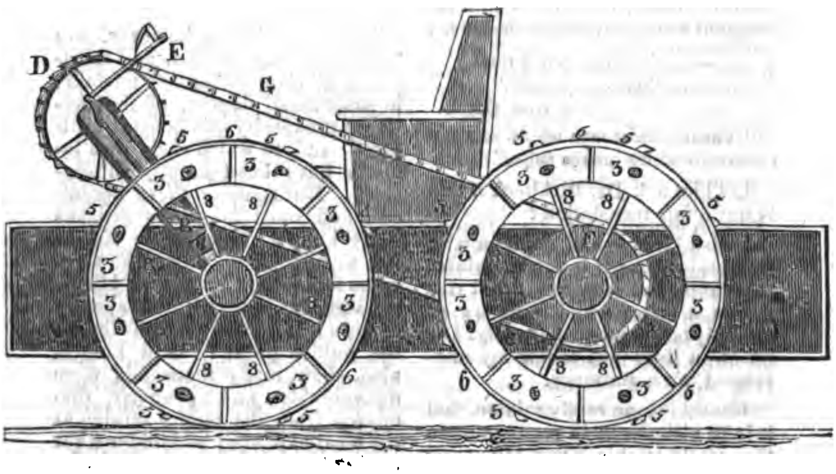
chisel and a hammer, as recommended by your Correspondent. This part of the process requires to be well done, otherwise the joint will not be sound. The ring serves the twofold purpose of preventing the cement running into the pipes, and keeping a sufficient space between the flanches to put the cement in. Upon trial they were all found to be good joints, and have continued so, and I think it will be found the best method of making the joints where permanency is required.

Mr. Way, in a subsequent letter, says, "he should doubt your Bow Correspondent being a practical man, if he were to judge by his letter." On the perusal of that letter I came to a very different conclusion, for I think there is a deal of useful information in it, and that it came from no other than a practical man. If Mr. Way will take the trouble to look over the letter again, he will find that he has misunderstood it with respect to the iron borings being *pounded*, as no such thing is mentioned.

I remain, Sir,
Your obedient servant,
J—— T——.

Henley-on-Thames,
June 13, 1825.

IDEA OF A SELF-ACTING CARRIAGE.



SIR,—The above is a representation of a Four-wheeled Carriage.

Description.

AA is an air-box, which may be made of any metal best adapted to stand the expansibility of air. The two axles are formed of hollow tubes, communicating with the air-box, A. The four wheels attached are composed of eight compartments, or pairs of bellows.

Figures 3 3 are valves; 5 5, knobs of iron affixed to the wood of the bellows, and passing through strong iron rings, 6 6. When the wheels of the carriage go round, these knobs are pressed upon the ground by the weight of the carriage, till they come level with the ring, 6, and thereby press the air from the bellows to the tubes, 8 8 8, which have a valve opening inwards, and into the air-box, A; whence the air forcing up the piston, B, drives round the wheel, D, by the crank, E. The wheel, D, is joined to a concentric wheel, F, by a chain, GG; and the wheels, D and F, may have small notches of iron to go into the links of the chain as it goes round. Piston B, in the act of flying up, will shut the

stop-cock communicating with the air-box, and open it in going down; or rather, there should be two pistons and cranks acting alternately.

By filling the air-box with compressed air, by the force-pump, to give it the first impulse, the action of the bellows will keep good the supply. If steam were applied as a power to a carriage upon this principle, it would supersede the use of a cogged railway.

I have seen a velocipede upon this plan, with but one large hind-wheel, and the small power-wheel, D, driven by the hands. There were two handles, one on each side; the one lying up, and the other down.

I am, Sir, yours, &c.

J—— M——.

Coldstream.

ANSWER TO THE SHIPOWNER.

Sir,—In reply to your letter of last Saturday, from "A Shipowner," allow me to offer him a word of Latin, quoted from an intelligent and most acute observer:

———— "*Mox* reficit rates
Quassas, indocilis——pati."
Hor. Ode 1.

"The impatient man *mocks* us about the repairs of his broken ships."

Let him ask Dr. Birkbeck if this is not a fair translation?

I wish Horace had gone on with this subject, for it is really painful to express the sentiments that rise out of a letter which appears so strongly tainted with malignity. The question does not touch my interest—I am a stationer.

Does this man really rejoice, that it is in his power to revenge upon thousands of his poor labouring fellow-countrymen some imagined insolence?—by himself much, and more by his influence, to deprive many families of comfort and of sustenance?—to impede the current of national prosperity?—to nourish with British capital the roots of maritime power in some rival state?—and, "at his own risk," *who remains snugly at home*, to expose many British crews to the hazards of the sea in unsound bottoms—in ships which he knows to require "extensive repairs?" The time, at least, is well chosen; this proposal may pass on Midsummer-day; but I want to know at whose risk he will send his crazy hulls into the Baltic from September to May? Let him ask Captain Lyon, or any of that brave crew, at whose risk ill-appointed vessels may be sent into northern latitudes?

"Never, perhaps, was witnessed a finer scene than on the deck of my little ship, *when all hope of life had left us*. Noble as the character of the British sailor is always allowed to be in cases of danger, I did not believe it to be possible, that, amongst forty-one persons, not one repining word should have been uttered."—*Lyon's Narrative.*

And is it men of this class that our "Shipowner" will make the instruments of a sordid resentment?

The shipwrights, however, are "stubborn, misguided, and short-sighted," if they desire to partake, in some small degree, of that national prosperity now generally diffused, and to which their own labours have been greatly subservient. But some of these ingenious and most laborious artisans "are known" to get from 70*l.* to 90*l.* a-year. *It is known.* The atrocious fact is laid before the blushing sun. O, unexampled rapacity of gain! O, insatiate vultures on the public purse! Is it known, also, how many thousands were unavoidably and properly dismissed from the public service at the blessed peace? and under what a cloud of privation and distress the trade has lain patiently for years, until, lately, the revival of commerce has opened a field for their labours, and *enabled* the shipowner to render them a fair remuneration?

The art of building having declined here, under the policy of such men, will their grandsons be ready, when Heaven shall afflict us with war, to send to these same continental ports for seventy-fours

and stout frigates to recruit the navy?

I now retire, for the sake of fair play, not because my heart is empty,

And remain,

Very respectfully, yours,

MODERATOR.

June 27th, 1825.

IMPROVED STEAM-ENGINE BUCKET—INUTILITY OF THE PAINTER'S REST WHICH GAINED THE ISIS MEDAL OF THE SOCIETY OF ARTS.

SIR,—Some years back, I was much inconvenienced in the working of a steam-engine of about thirty-five horse power, by not being able to get sufficient cold water to condense. My pump seemed to be too small, and the situation of the well, and other local circumstances, made it impracticable to have a larger pump, or to lengthen the stroke, without great expense and alteration. I consequently constructed a new sort of clack and bucket, whereby I thought more water could be brought up, well knowing that much water is lost through the ordinary clacks, and afterwards through the buckets, in bringing it up from the working part of the barrel or pump-tree. The result answered my most sanguine expectation. The vacuum I formed was stronger; the quantity of water I brought up was very considerably more than before, and for four years (since which I first adopted the plan) I have had plenty of water. I have shown the bucket to several scientific people, who all spoke very well of it. Continuing to find great benefit from it, I thought it, at last, a pity that it should not be made better known. I therefore made not only a communication of it to the Society of Arts, but mounted a six-inch bucket complete, which I sent to that learned body. The result was, that after it passed the examination of their Committee, no merit was found in the contrivance, and I got my bucket back. This did not surprise me, because I am well convinced that man generally overrates his own talents; but what did surprise me, was, that the silver Isis medal was at the same time presented by the Society of Arts to a gentleman, for the invention of a Painter's Rest, to be used as a substitute for the common maul-stick. This said rest is upon the principle of a fire-screen, which vertically slides up and down.—Now you must know, Mr. Editor, that in my younger days I was an amateur painter in the Netherlands; Mr. La Croix, of Bruges, was my instructor; and I was intimate with Solvyns, of Antwerp, and several other eminent painters of that day, and I venture to assert boldly, that the said painter's rest is totally unfit for its intended purpose, if the painting is to be of any size above a few inches. Sir Joshua Reynolds and Hickel (the latter I was personally acquainted with) would have laughed at this painter's rest; because the maul-stick serves not only as a rest, but also as a lever of the second order. The fulcrum is at that end which, muffled, rests on the canvas or pannel; the rest of the arm is the weight, and by the power of the hand at the other end the rest is conveyed in all the necessary directions, which cannot be done with the aforementioned newly-invented rest, without constantly shifting the machine, and painting at the same time! The maul-stick performs another duty—it is a hold and rest for the hand that carries the pallet.

I beg you to excuse this digression. To return to my bucket, I have only further to say, that its good qualities chiefly consist in this, that nothing can obstruct the entrance of the fluid, as in other large buckets. The entrance is clear and free; the clacks or doors, which are of brass, are so fitted as to make a perfect joint which holds water; and the longer it works, the closer these doors bed themselves. The gudgeons do not

work in a ring or filbox (as some call it in this country), but in a half-circle, so that when they shut they fairly bed upon the shell; and as by working they groove themselves into the shell, the whole of the door goes down parallel with its bed. I only beg leave to add, that if you, or any of your Correspondents, wish it, I shall be happy to send you the same bucket which I have submitted to the Society of Arts. I have no other view in this offer but to serve the well-meaning part of the public.

I remain, Sir,

Sincerely yours,

D——.

Warrington, May 28th, 1825.

[If our Correspondent could send us a good drawing and description of his improved bucket (to which we will readily give insertion), they would probably serve all the purpose of an actual inspection of the bucket itself. But should that be inconvenient, he will confer a favour by sending us the model, to the care of our Publishers.—Ed.]

RAPID EVAPORATION.

Professor Œrsted has pointed out a method of considerable utility in the evaporation of liquids. He fastens together a great number of fine metallic rods, or wire, and puts them in the bottom of the distillery or evaporating vessel, and by this means he distils seven measures of brandy with the same fuel, which, without the rods, would distil only four.

GEORAMA.

An establishment, under this title, has been erected in Paris, consisting of a hollow sphere forty feet in diameter, within which is laid out a general map of the world, executed by the best artists. A spiral staircase ascends to three circular and insulated balconies, whence the spectators can view every part of the sphere, even in its most minute details.

Notices to our numerous Correspondents will appear in the next Number.

*** Advertisements for the Covers of our Monthly Parts must be sent in to our Publishers before the 20th of each Month.

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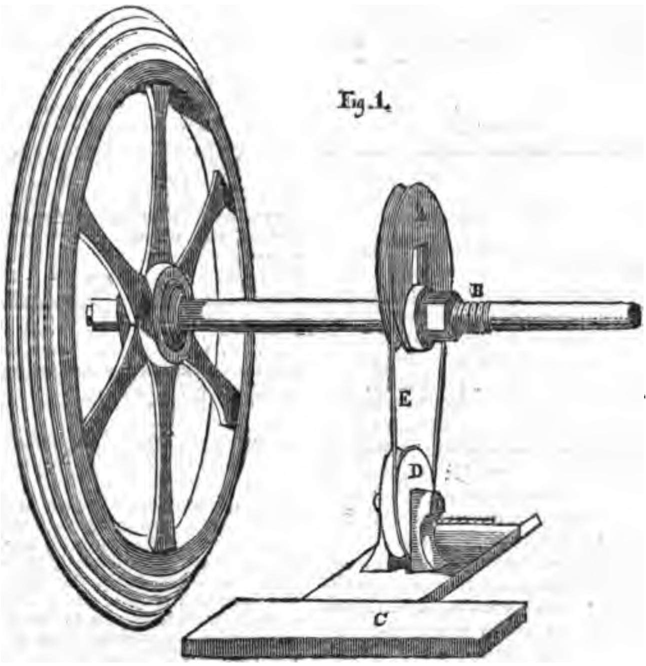
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 98.] SATURDAY, JULY 9, 1825. [Price 3*d*.

———— " Art thrives most
Where Commerce has enrich'd the busy coast;
He catches all improvements in his flight,
Spreads foreign wonders in his country's sight,
Imports what others have invented well,
And stirs his own to match them or excel.
'Tis thus reciprocating, each with each,
Alternately the nations learn and teach;
While Providence enjoins to every soul
A union with the vast terraqueous whole." *Cowper.*

IMPROVEMENT ON THE LATHE.



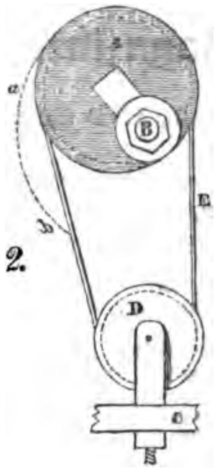


Fig 2.

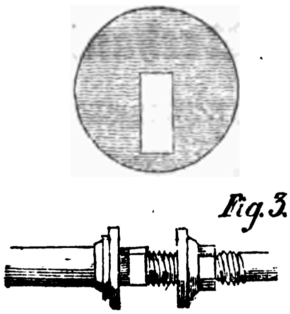


Fig. 3.

IMPROVEMENT ON THE LATHE.

SIR,—Having occasionally, in my leisure hours, amused myself with turning, I have noticed the difficulty there is in having the crank, that moves the wheel, of such a height, as to answer conveniently for turning both large and fine work. A high one gives power and ease in working, but is apt to affect the steadiness of the hand; a low one admits of a delicate and steady application of the tool to the work, but is inconvenient in turning any thing heavy, on account of the small purchase.

It has occurred to me, that it might be possible to apply the eccentric circle, instead of the crank, to the purpose of turning the lower wheel of the lathe, and that it might combine the advantages of both a high and low crank, by making it to adjust at different degrees of eccentricity, so as to give a variety of powers, according to the purpose for which the lathe is at any time to be used. I enclose you a drawing that may serve to elucidate my meaning; observing, that I intend merely to give a hint, in hopes that some person more intelligent than myself in these things may think it worth improving on; that is, if the plan has never been before tried, of which I am ignorant, my usual occupation not leaving me time to penetrate very deeply into mechanical knowledge.

I am, Sir,

Your very humble servant,

W——.

Walworth.

Description of the Drawing.

Fig. 1, a perspective view of the wheel and spindle, with eccentric circle affixed; the spindle is supported between centres in the usual way. A, the eccentric circle, of metal; the edge of it is cut into a deep groove. B, a screw and flanch, for the purpose of increasing or diminishing the eccentricity, thereby increasing or diminishing the force, and rise of the treadle or foot-board. C, the foot-board. D, a pulley, grooved to correspond with the circle, and turning on centres; round it passes the flexible band, E, which communicates the motion to the circle and spindle, on pressure being given to the foot-board, which rises and falls in the usual manner.

Fig. 2, a profile view of the same.

Fig. 3, the circle, and a portion of the spindle separately exhibited.

When the eccentric circle is in the position represented in fig. 2, if the foot-board be pressed downward, it will be drawn in the direction AB, the wheel, D, turning on its axis at the same time; the force of the large wheel will then carry it on till it returns to the first position, when the pressure being repeated, the motion will be continued, as by a common crank.

FORTY-SEVENTH PROPOSITION OF THE FIRST BOOK OF EUCLID.

SIR,—Happening, a few days ago, to take up your excellent and scientific work, I opened it at the demonstration of this proposition, page 351, vol. III., and was surprised at the great inaccuracy and unmathematical mode in which this demonstration was proceeded in: but not having then time or inclination to go deliberately through the whole, I laid it down, reserving any comment I might make for some other opportunity, which opportunity has now arrived. On looking, therefore, at the figure as delineated (page 351), the *postulata* appeared well enough arranged for a *practical* demonstration; but when I proceeded to go through it, they did not reduce it to that mathematical certainty which alone is a proof of correctness.

In the first place, the postulata (supposing the squares to have been previously drawn) appear to me to be incorrectly worded for the use to which they are afterwards put, or, rather, they are not the proper means used for obtaining the required figure.

In the second place, the referential letters are not arranged with the nicety they ought, showing at once the relative catenation of the argument; but, setting aside that, as well as the untechnical expressions used throughout, I will proceed to state,

In the third place, that were you not to examine the figure, and ascertain that TM and EK are parts of DP and AK, and TE and MK are also parts of TG and MH, you could not possibly allow that ETMK was a parallelogram.

In the fourth place, the line TD is equal to the line TE, not *because* it is the adjacent side of a *parallelogram*, but *because* it is so of a *square*.

In the fifth place, the conclusion that the whole figure, KMPS, is equal to the whole figure, BTEC, is not proved from the premises set forth; for we have no means of ascertaining from them, that the remaining sides, BC, CE, are equal to the remaining sides, MP, PS; and by no proposition of Euclid prior to this is it proved, that by having the four angles and two sides of one *quadrilateral* figure equal to the four angles and two sides of another, those two figures are of the same shape.

This conclusion, therefore, having failed, it would be useless for me to proceed to subsequent ones. Remaining, however, a great admirer of your excellent work, I subscribe myself,

Your obedient servant,

EDWARD.

THE "NEW DIVING APPARATUS."

SIR,—Perceiving, in the 96th Number of your Magazine, an account of a new Diving Apparatus, by a person signing himself "T. B. of Leicester," I beg to say, that I have a patent, dated the 29th of May last, for an apparatus precisely similar in principle; and it is rather singular, that one of the first drawings I made of my invention also corresponds exactly, excepting in one or two trifling particulars, with the drawing your Correspondent has added to his description; which also, in part, particularly in his N. B., where he enters upon the calculation of the quantity of atmospheric air inhaled at one time, the number of inhalations per minute, the capacity of the vessel, the number of atmospheres condensed therein, the time a person may remain under water, &c. are, as near as possible, the quantities stated by me to Mr. Bate, optician, Poultry, London, more than two months ago. I likewise explained the principle, before that time, to one of the Directors of the Pearl Fishing Company; and I have now been constructing the apparatus in Birmingham for the last six weeks. I described the invention, also, particularly to Mr. Wm. Newton, of Chancery-

lane, more than three months ago, and made an affidavit of the invention before a Master in Chancery, on the 26th of March last. I can likewise prove, by witnesses of the highest respectability, that I fully described the same to them more than twelve months since. If your Correspondent, therefore, has received the idea from others, I hope he will have the candour to acknowledge the same; if, on the contrary, they have originated with himself, I have only to say, it is a most singular coincidence of thought.

You will oblige me by mentioning another part of my invention, which my patent includes, the title of which is as follows:—"For certain improvements in apparatus for diving under water, the whole or part of which apparatus is applicable to other purposes."

I apply part of the same apparatus to the propelling of carriages and vessels, by the expansive power of atmospheric air in a condensed state. I constructed a carriage on this principle more than a year ago, which was exhibited in motion to a few individuals, and was found to answer their most sanguine expectations. I have not hitherto brought it before the public, on account of the difficulty of constructing a hollow vessel of sufficient strength to contain the necessary quantity of atmospheric air in a condensed state, without being too heavy and cumbersome for the convenience of locomotion. Having now accomplished this object, I expect shortly to have it in my power to construct carriages which will move by the before-mentioned power of condensed air; and which (should they on trial be found to succeed) will, in point of safety, economy, expedition, and convenience, probably exceed any other kind of carriages now in use.

My patent has other applications of minor consideration, which, of course, will shortly appear in my specification.

W. H. James.

Winson Green, near Birmingham,
June 28th, 1825.

HORIZONTAL WHEEL—NEW CHURNING MACHINE.

Sir,—I learn by a communication from New York, that the Rev. Dr. Phœbus, of that city, has constructed a Horizontal Wheel, to be propelled by the wind, the plan of which is extremely simple. There are eight horizontal rays or booms attached to a perpendicular shaft, and on these booms as many sails (in form of a jib) slide out by rings as on the masts of a vessel; each sail is then belayed or fastened (from right to left) to the front ring or *travelles* of the left-hand sail; and they are suspended so far *below* the booms as to receive the full impression of the wind—all *horizontally*.

In the revolution of this wheel, it will be readily perceived that the sails turn their backs (or booms) to the wind upon the one side, and form no impediment to the full force of the breeze upon the other side; and they slide out and in with so much convenience, that any length of the sails may be extended at pleasure, or the whole tucked up close at the centre. One, two, or more of these wheels may be attached to the same perpendicular shaft; and it is hardly necessary to say, that they may be applied to almost every description of machinery.

The wings or sails may be formed at pleasure, either of canvas, as above mentioned; or, agreeable to Hooper's plan, to open on rollers; or, on the late improvements of Forman's plan, made of thin sheet-iron, to open and close like a Venetian blind.

Another useful invention, which has made its appearance in America, and which, like the former, is the work of a clergyman (the Rev. Mr. Wilmott, of Wilton), is a new Churning Machine, which, for ease and expedition, and the quantity and quality of the butter, is believed to excel any thing of the kind heretofore in use. The body of the churn is square at the bottom; the two opposite sides are perpendicular; the other two op-

posite sides converge or incline towards the top. The dasher consists of two arms, hung on pivots or pins on each perpendicular side of the churn, which, projecting down almost to the bottom, have inserted between them a number of slats, or thin pieces of wood. On the top of these arms are framed two levers at the centre, so as to project horizontally each way, and connected at each end with rounds. The dasher moves or vibrates in a manner similar to that of the patent washing-machine. By this means a powerful force is mechanically applied to the cream, uniformly straining and agitating the whole at every vibration, with great ease to the operator. Children can use it. The principal specific improvement in this machine is the pendent swing-dasher. The advantages mentioned are at once obvious from the description.

I am, Sir,

Your obedient servant,

CLIO.

PRIZE CHRONOMETERS.

SIR,—Having just received the late Numbers of your useful Publication, to which I am a constant subscriber, I beg leave to intrude a few observations, suggested by what has appeared in Numbers 93 and 95, under the head of "Prize Chronometers." Your Correspondent, under the signature of "A Real Workman," takes for granted, that the Government, in receiving chronometers for trial at Greenwich, had in view the encouragement of real workmen in the branch of chronometry, and not the mere sellers of chronometers. Upon this head I differ with him, and am more inclined to believe, that the object of the Government was to obtain, if possible, good chronometers, without regarding whether they came from real makers or mere sellers. Should, however, your Correspondent be correct in his opinion, nothing certainly could be more foreign to the object in view, than the admission of a very large proportion of the chronometers that have been sent for trial; as they are known, to most of the practical workmen in the trade, and also to many gentlemen of science, not to have been made by the persons whose names they bore. But your Correspondent has acted indiscreetly, in asserting of Messrs. Murray and French, that they never made a chronometer themselves. His honest zeal for the interests of "real workmen" should not have led him to this, since he will find it a difficult task to prove this assertion, which he has been challenged by Mr. French to do. However strong may be the conviction in the minds of real workmen, that the majority of those who call themselves *manufacturers* of chronometers are neither qualified by their scientific attainments, nor by their practical experience, to make a chronometer, it is next to impossible to furnish sufficient and satisfactory evidence that they never did make one.

The communication of this Correspondent did not, however, as a whole (as it appears to me), call for the very harsh language used by Mr. French, in the reply which appears in your publication of the 18th instant. The want of temper which pervades that reply, is as much to be lamented on Mr. French's account, as it is on behalf of truth and science; for the cause of the latter is in no chance of being promoted by angry disputation, neither are the private interests of individuals likely to be much benefitted by reviling those who may in any way become their antagonists. In reference to the charge of your Correspondent of the 4th instant, Mr. French says, that "the motive is too obvious to be mistaken, and too *malicious* to have any effect with a discerning public." Now, it appears to me quite clear, that, obvious as the motive of this writer is, Mr. French has mistaken it, for he infers *malice* from it—a thing of so base a description, that it ought not to be inferred from the motives of any man upon slight grounds. The evi-

dent motive of the writer was, to awaken the attention of the public to the fact, of certain gentlemen having been rewarded for machines which, he believed, they never made; and which rewards, in his judgment, ought only to have been given to those who were really and effectively the makers of the said machines. I shall leave to the good sense of your numerous readers to determine how much this savours of malice, for I do not deem it necessary to waste a moment's time in the inquiry myself.

Mr. French gives an unqualified denial to the charge of never having made a chronometer, and of being but a mere "dealer and chapman;" but, with all due deference to Mr. French, I must say, that a declaration on his part, that he really made the chronometer in question, and also those which have appeared, and those which now are, at the Royal Observatory, bearing his name, would have been far more effective in silencing the complaints of real workmen than any thing which he has said. Indeed, unless Mr. French can affirm that he is the real maker of the machines above mentioned, I must be excused for regarding him but as "a dealer and chapman," so far, at least, as regards the article of chronometers. I know nothing personally of Mr. French, but am very willing to give him credit for all the skill and ingenuity which you, Sir, say he possesses; and as true genius and real talent have nothing to fear from the jealousy or the animadversion of *rivals*, whatever may be unjustly said or written in the spirit of rivalry, can only have the effect of placing the merits of Mr. French in a more conspicuous light. I can assure Mr. French, that, although a real workman, I have not the honour to be one of his rivals; I therefore trust, that I shall not lie under the suspicion of being actuated by envy or jealousy, or any other unworthy motive. I am not one of the "real workmen" who have in any way complained that injustice has been done in the distribution of prizes, and in addressing you, are not animated by that *esprit de corps* which may be presumed to appertain to that class. My only motive in this communication is, to call into action, if possible, the talents of those persons who may be much better qualified than myself to enlighten the public, as to the real merits of the several competitors for the prize chronometers, and to endeavour that, if the rewards go into the pockets of *nominal* makers (which, it has been asserted, they sometimes do), the *empty* honours shall at least be decreed to the real ones. In order to avoid every misapprehension as to the meaning of terms, and to prevent the possibility of my being supposed to understand, by the terms "real maker," a person who shall make the machine, in all its parts, from beginning to end, I beg leave to add, that I consider the chronometer-maker to be distinguished from the watch-maker, by his knowledge of all those parts that distinguish chronometers from the best watches, and by his competency to execute them. For example, the escapement, with its functions; the balance, with the means by which the effects of different temperatures on the spiral spring are neutralized; and, lastly, the spiral spring, with its properties of rendering the vibrations of the balance isochronal, or of retarding or accelerating them in any required degree. It may also be added, that the good chronometer-maker should possess scientific knowledge sufficient to see that the other parts of the machine, which are made by less talented workmen, are arranged and executed in the best possible manner; but this latter qualification, it will be agreed, is requisite to constitute even a good watch-maker.

I must object to Mr. French's definition* of a chronometer, which,

* I hope it is not upon this definition that Mr. French denies the truth of the assertion, that he never made a chronometer; for it is certain that he could not have served the laborious apprentice-

he says, "includes every machine for the admeasurement of time." It is, I presume, upon some such definition as this, that so many persons in London and elsewhere call themselves chronometer-makers, who are known in the trade to possess no other qualification than that acquired by the routine of a seven years' apprenticeship to a finisher of vertical or other watches.

I abstain, Mr. Editor, from offering any remarks on what you yourself have written on the subject in question in Number 95. No one can deny the justice of your general reasoning; but it must also be admitted, that what you have therein said on the merits of Mr. French, will only apply to him on the supposition that he is the *real* maker of the machines to which you allude. If he be the real maker of those machines, too great praise cannot be given him, nor too great a reward bestowed on him (for unquestionably they are of great excellence), and Mr. French can only add to his fame by avowing himself such; if he be not the real maker, the honours you have done him appertain by right to some other person or persons, and since, according to your testimony, the whole world gives Mr. French credit for being a man of talent, I trust he will give the whole world an opportunity of allowing that he is also a man of candour, by publishing, through the medium of your valuable Magazine, the names of the real makers of those machines, and thus place the laurels on the brows of those whom they ought to adorn.

I am, Sir,

Your very obedient servant,

G. MUSTON.

188, Fleet-street, June 30, 1825.

---

ship, which he states he did, without having made many "machines for the admeasurement of time." Vertical and other watches are machines of this description, but they are not chronometers, in the ordinary acceptation of the term, though they would appear to be so according to Mr. French's definition.

ON THE STOPPING OF ASTRONOMICAL CLOCKS.

BY WILLIAM HOWARD, M.D.
Professor of Natural Philosophy in the University of Maryland.

One cause of the stopping of delicate astronomical clocks, has been supposed to be the attraction exerted by the weight on the bob of the pendulum, when the two become opposite to each other. The very minute quality of this attractive force renders it difficult to conceive that it can so disturb the motion of a heavy pendulum as finally to stop it, and the following observations induce me to believe that, in the cases which have been thus explained, the true cause is very different.

I have a French clock, with a very heavy half-second compensation pendulum, fitted with Lepaute's dead-beat escapement. A weight of one and a half pounds, in descending eleven inches, keeps it in motion a week. The pendulum is supported by a strong upright bar of steel, which also supports the pulley, over which passes the cord which suspends the weight. This clock I found frequently to stop when the weight descended nearly opposite to the pendulum, from which it was then distant about three-fourths of an inch. This I attributed to the attraction of the weight and pendulum, and determined to remove the weight to a greater distance. Before this was done, however, on attentively observing the clock, I found that, before it stopped, the weight acquired a considerable oscillation, evidently communicated from the pendulum through the common support. To destroy these oscillations, I placed a perpendicular wire by the side of the weight, the whole line of its descent: on this a ring was permitted to slide, and was connected with the weight by a delicate spring. This spring, by constantly pressing the weight towards one side, prevented the oscillations from taking place, and com

pletely effected the object, and the clock has since continued to go without any interruption. The experiment has been often repeated, of supporting two clocks on the same horizontal beam: if one be set in motion, it will, in a short time, communicate its motion to the other, and if both pendulums be of the same length, they will continue their beats with perfect isochronism. This sympathy, which also exists between two watch balances which are supported by the same plates, has been ingeniously used in practice by Breguet, who has constructed clocks and watches, each including two distinct movements, having no connexion together except by the plates which form the common support. In these time-keepers the pendulums and balances beat perfectly together, and thus one pendulum or balance is made to correct the irregularities of the other.

If this experiment be made when the pendulums are of different lengths, the clock first in motion will be stopped. This effect can be transmitted through media apparently very solid, and probably has taken place in the instances when the clock's stopping has been attributed to the attraction of the pendulum and of the weight; in such cases the weight suspended by its cord becomes a pendulum of nearly the same length as that of the clock. The remedy is easy, merely to conduct the cord of the weight to a different support from that which sustains the pendulum.

OBJECTIONS TO MR. HIGGINSON'S PLAN FOR PRESERVING PERSONS IN DANGER OF SHIPWRECK.

SIR,—The facility with which new inventions are brought before the notice of the public, through the medium of your highly useful Magazine, cannot fail of producing a great deal of good to the community, particularly as your pages are open to discussion, by which the merits of any plan or invention may be fairly investigated, and its utility or inutility be established. Now, Sir, I am disposed to think that Mr. Higginson's invention, described in your 94th Number, is particularly obnoxious to animadversion. It reminds me of the fable of the mice assembled in council, in order to adopt some plan of security against the ravages of puss, and the young mouse's proposition as to the bell being suspended to her neck. But as Mr. Higginson may, perhaps, be prepared with answers to any objections offered to his plan, I will, with your permission, ask him a few questions, by the answers to which he will have an opportunity of laying the merits of his invention in a fairer point of view; and if he can overcome the obstacles I shall name, he will deserve immortality for his pains.

First, then, let me ask, how is a balloon, capable of containing 2000 feet of hydrogen gas, to be filled amidst the bustle and confusion which, I *suppose* (for I never was in such a situation), must prevail on the deck of a ship in a storm, and in the utmost peril of being lost?

Admitting that in this confusion the rolling of the vessel, by which the apparatus is liable to be deranged, and that the rigging of the ship, &c. offer no obstacles to the process of filling the balloon, which I think, under these circumstances, next to impossible, how can the balloon be supported, while filling, against the fury of a hard gale of wind, which, if the balloon be made fast to the cask and the cask well secured, must tear it away in a moment? I am sure this must inevitably be the case.

But, admitting the materials and fastenings to be sufficiently strong to resist the sweeping energy of the storm, how is the gas to enter when the sides of the balloon are collapsed so forcibly by the same powerful pressure? Would not the cask be in danger of bursting by the expansive force of the gas?

Now for the fuse!—How is it to be prevented communicating fire to the hydrogen gas, if, by accident, a little bending of the lower part of the balloon should take place, and bring the side of the balloon in contact with its fire? a thing likely enough to happen, particularly at starting, especially if the wind should happen just then to be very angry.

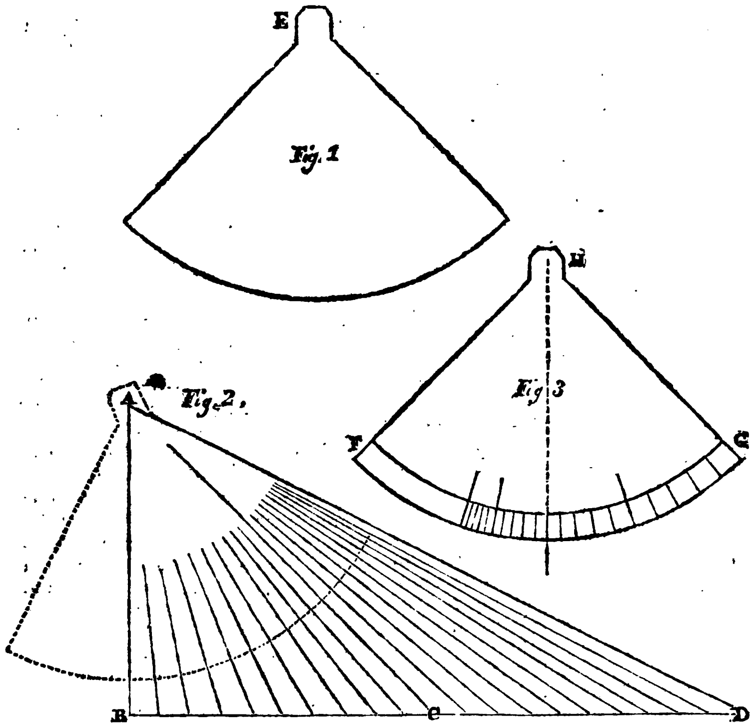
In the next place, let me ask Mr. Higginson *how long time* a balloon of the requisite size would require to fill it? This is important—would it be less than an hour? A serious time to people in *momentary peril* of their lives!

If Mr. Higginson will answer these questions satisfactorily, he will very much oblige

AN OLD MOUSE.

Hôle in the Wall.

INSTRUMENT FOR MEASURING HEIGHTS.



SIR,—Simplicity, combined with the power of producing the desired effects, is ever the grand desideratum in all new inventions and improvements. Of course, then, the simplest of two instruments for producing the same results must be the most desirable to be known. Under this persuasion, I send you the following plan for Measuring Heights, which will be found to give equally as correct results as the plan you have already published (page 167, vol. iii.), and by a far more simple process.

To construct the Instrument.

From a circle, the radius of which

shall be of the length required for the instrument, say 12 inches, cut out fig. 1, leaving the centre complete and perforated; any shape between a sextant and a quadrant will do.

On a plane board draw the perpendicular line, AB, fig. 2, of somewhat more length than the above radius; and likewise the horizontal line, BCB, to two, three, or four times the length of AB, as shall seem expedient. (In this figure only twice the length is given, which will be sufficient to give an idea of the principle.) Divide BC and CD, that is, each portion of the horizontal line which answers in length to the perpendicular, AB, each into ten equal parts, which connect with A, as seen in fig. 2.

Place fig. 1 on fig. 2, passing a pivot through the perforated centre, E, to fix in fig. 2, at A; and then bring fig. 1 into the position described by the dotted lines. Then place a straight edge over the line AB; and as fig. 1 is passed beneath, to coincide with each of the lines between A, the divisions on BCD describe the lines as seen between F and G, fig. 3. Remove the pivot which confines fig. 1, and suspend a plummet in its place; which, with the addition of sights at G and H, completes the instrument as seen at fig. 3.

Method of Use.

Approach the object, the height of which you wish to ascertain, until the plummet-line falls on any one of the divisions on the instrument. Here fix your chain or measuring-tape, and either approach or recede, no matter which, till the plummet-line falls on the next division. Then the length of the chain or tape run out is a tenth of the height required, which is immediately known by the addition of a cipher. This is the whole process required, which is certainly not very complicated.

I have been as brief as possible in the description, but I trust that it will not be found obscure.

The first hints which I received for the construction of this instrument, were from considering the properties of the right-angled triangle. The first application I made, was to discover the *extremity* of the base equal to the perpendicular height; but this method was not applicable to hills, nor any other object, the base of which was inaccessible, as the measurement of the whole base was an indispensable object to be attained. Time and reflection, Mr. Editor, have taught me the above expedients; and should they prove useful or amusing to any of your readers, I shall be quit of some portion of the debt which I owe to you and your many able Correspondents.

I am, Sir,

Yours respectfully,

R—— H——.

CASE OF THE SHIPWRIGHTS.

Sir—The existing differences between the Ship-builders and the operative Shipwrights of the River Thames, are but little, and very imperfectly known, to the mercantile world in general, excepting those more immediately interested in shipping. A distinct body of trade, I consider, by comparison, to be similar to a family, who should be left to settle their dissensions and misunderstandings among themselves; but when I see your Correspondent, "A Ship-owner," step forward and arraign the numerous class of workmen with whom he is (or rather *should* be) connected, on national grounds, I conceive that a case is constituted on which every man is entitled to pronounce an opinion. Although not an operative shipwright, therefore I may be permitted to offer what occurs to me in their behalf.

Having been a witness of several general meetings of the operative shipwrights, having seen their conduct upon those occasions, and having heard their discourses and resolutions, I was surprised at the

intelligence of the speakers, and could draw no other conclusion than order, reason, and justice would infer. That a whole body of men should absent themselves from work, is a subject of great importance; that commerce should be affected by it, is also of no small moment, and the causes of such conduct are worthy of consideration; no single transaction could have so affected above a thousand persons. The grievances must have been many and intolerable, which caused so large a class to undergo the privations they have done. If the Shipowner had inquired into the *causes* of the dissensions in all their bearings, he might have ascertained the real state of things; he might have learnt from the operative shipwright himself, that *no increase of wages* is sought after, and that wrongs very sore have been the spring of all the mischief which has ensued. How dearly does every Englishman love the constitution of his country and its rights! and shall the rights and privileges of trade, which are so nearly allied to its very existence, be trampled upon with indifference? Shall the innovation of those rights, which affect the comforts, and consequently the habits of the people, be borne with servility? Shall the whims and caprices of every new *competitor for business* be for ever changing the order of things, and entail destruction on the common usages of trade? One class of masters say, 'though, since the memory of man, you have had your own *chips*, still, because the privilege has been abused by a few, you shall all be deprived of it.' Here, then, was the very fire taken from under the workman's kettle. *Other* masters affect to dock their ships for nothing; and the working man, in *anticipation of a job*, must attend without pay, perhaps a night or a day; nay, even when the anticipated job is secured, there is a stage to erect, which also must be done for *nothing*. Now, Mr. Shipowner, you cannot be so blind, or so ignorant of the wants of man, as to suppose he can spend a day's labour without pay or food.

The Shipowner tells the public, that, at another port, he can repair his ship at half the expense, as compared with the Thames; how far that *system* of repair may *answer his purpose*, his future proceedings will show. The river-built ship might also have been brought into the same comparison; but through all his love for his money, no great penetration is required to perceive that, with all the exorbitant expenses, he would rather repair in the old Thames. With respect to the exorbitant charges here, all I can learn is, that the shipwright receives his five shillings per day, and chips were allowed, when working by day; and when by job and task, at such rates as the judgment of *each* builder shall think fit. Here is another source of misunderstanding; no specific rates are established for job-work, and no regular system carried on.

I will sum up with a very few observations. A labourer is worthy of his hire; and when allurements are held out to him to do a piece of work, never mind, *new or old*, at the expense of another, there is a system of deception implied. Let every man "bag his own knee;" so should every job bear its own expense.

I am, Sir,

Yours very respectfully,

A Friend to Truth.

Sir,—I feel greatly obliged to you for the candid offer of your pages to discuss the question which "A Shipowner" has, by his letter, agitated in your Magazine of the 25th ult., relative to the dispute between the master-shipbuilders and their men; but, before I proceed to a discussion of that letter, allow me to acknowledge the very great obligation which the shipwrights are under to some unknown friend who has taken up the pen in their behalf, under the signature

of "Moderator." Although evidently unacquainted with all the particulars of the dispute between the parties, and although he has himself no personal interest at stake (being a stationer), yet, with the characteristic anxiety of an Englishman for the honour of his country, he has handled the matter on national grounds, and demonstrated that, according to Mr. Shipower's own showing of the case, the conduct of the masters is alike sordid and unjustifiable.

The Shipowner, Sir, must be either ignorant of the subject he writes upon, or he has most wilfully and palpably misstated the case. He roundly asserts that he is one, among others, who has "suffered loss by the combination of shipwrights for increased wages." This I most unequivocally deny; wages do not form the cause of contention between the men and their employers. It was for a matter of right, founded upon the principles of reciprocity, a privilege which the operatives always enjoyed, of employing such persons on their contract work as they considered best qualified for their purpose, that they stood out. This right was never questioned till the Shipwright's Union was formed, and the people made a demand of payment for work done, which, in many yards, they received nothing for before, when some "misguided, stubborn, short-sighted" agents stirred up others to join them in their stretch of power, that has caused all the dispute. The Shipowner must certainly be in one of his day-dreams, when he asserts that the "evil has driven himself and many others to the *necessity* of seeking a remedy elsewhere." This word, *necessity*, is false in fact; for out of from 30 to 36 master-shipwrights, there are not more than half of them that have formed the combination against the privileges of the people; consequently there were numerous other places where the Shipowner might have repaired his ships.

In another part of his letter he says, "that he can get his ships repaired in the North of Europe at a much less expense—in some cases for one-half, and in no instance for so much as two-thirds, of the cost of effecting such repairs here." But this is altogether a visionary speculation, or, at least, can only be partially realized, and then only at certain periods of the year, as Moderator most justly observes. Does the Shipowner take into his calculation the expense and risk of taking his ships to the North to be repaired? And then some allowance must surely be made for the difference of workmanship, which I would calculate at least at one quarter the repairs. I think, when all these little matters come to be thrown together, there can be no doubt but it will operate on the feelings of this mercenary Shipowner more effectually than the combinations of the river shipwrights. Ay, but the rub is, the men get from 70*l.* to 90*l.* a-year. Indeed! What a crime for men to get from "70*l.* to 90*l.* a-year," whilst the shipowner can only get from 70 to 90 hundreds of pounds a-year, and that through the mental and physical acquirements of the very men who are perfectly contented at receiving from 70*l.* to 90*l.* a-year! This is monstrous, to be sure. The truth, however, is, that though there may be some few cases out of 1500 of men receiving from 70*l.* to 90*l.* a-year (and even that sum is insufficient to meet the expenses of a family, buy tools, clothes, &c. and give the honest and industrious mechanic the means of appearing with that respectability which his professional avocations give him a just right to), yet there are hundreds of shipwrights in the River Thames that do not average 40*l.* a-year, and for many years after the peace, not 30*l.* a-year.

The Thames shipwrights laugh at the idea of foreigners coming here to do their work, or shipowners sending their ships abroad to be repaired by foreigners; and have been a good deal surprised at the weak and inconsiderate asser-

tions which have been used to this effect in the House of Commons. They have too much of that good sense and intelligence (which an hireling scurrilous writer in the *Public Ledger*, under the signature of "Verax," talks about) to be the least alarmed at words, particularly when experience has convinced them, that very few shipowners will sacrifice their own interests to satisfy the sordid and despotic views of any master ship-builder. The Shipowner, in his letter, is absolutely censuring his best friends, the operatives, and is bound, by every principle of reason and justice, to patronize their proceedings. They have long laboured to establish a system of measures, which must ultimately improve the general mode of working, and also give a more definite knowledge of the value of that labour which is so advantageous to the shipowners.

Should I hear any more of the Shipowner, I hope you will indulge me with an opportunity of more fully explaining the latter part of my letter, relative to the interest of shipowners. I hate ambiguity; my motto is, "Reciprocal rights."

I am, Sir,
Yours respectfully,
JOHN GAST, *Shipwright.*
Rotherhithe, July 5, 1825.

INQUIRIES.

NO. 134.—HOW TO VARNISH STUCCO IMAGES.

SIR,—I have several very handsome images, which I have bought of Italians in the street, which are made, I believe, of plaster of Paris, and I find that, in wiping off the dust which accumulates on them, it, as it were, *smears* them, and almost entirely, in the course of a very little time, defaces the features. By this means the countenances of two of the most interestingly studious infants I have yet beheld are become almost effaced. Diana herself, under the remorseless influence of the dusting brush, loses all animation of countenance, and her once finely formed limbs are worse than no limbs at all; Cupid, with his bow, looks like a defaced wooden doll; and Hercules wears the appearance of a naked Irish pavior resting on his thumper.

In order that I may avoid this destruction to the *beauty* of my fragile collection, I shall be glad if any of your Correspondents will inform me of any method by which these may be painted or varnished over in such a manner as to enable them to bear cleaning without deteriorating from the beauty of their forms, and without altering their colour, at least no farther than to a stone colour.

I once tried to varnish an image over with what is called Brunswick black, and which is used for varnishing the grates of stoves, &c.; but on applying it to the image, it sank into it, and I scarcely believe it would ever have been saturated, for I repeated the application at least half a dozen times without producing any other effect than a dead kind of black.

I am, Sir,
Your obedient servant,
AURUM.

NO. 135.—A SAFETY GIG.

SIR,—Is it possible to construct a Safety-Gig (built much like a stanhope or tilbury) so that the shafts should be always in a horizontal position, or nearly parallel with the ground, whether the horse was in the gig or not? Or one, the body of which should always be in its proper position (the same as when people are sitting in it), but the shafts of which should move on hinges, so that they could rest on the ground (when no horse was harnessed to them) without at all affecting the upright position of the body or seat of the gig? When a horse tumbles in a gig, the shafts go to the ground with the animal, and by being connected or annexed to the body of the gig, that also is

cogged up, so that those sitting in the gig are violently precipitated forwards, by which many lives have been lost, and the most serious injuries occasioned. The great object is to prevent the motion (up or down) of the shafts from having any effect or power over the motion of the body of the gig, which would be by no means difficult if a gig were not a two-wheeled vehicle. The horse might then fall to eternity, and those sitting in the gig remain perfectly quiet and uninjured.

I am, Sir,
Your obedient servant,
R——.

NO. 136.—IMPROVED BUGLE-HORN.

SIR,—Perhaps it would be no very difficult task to make a trumpet or bugle-horn, with a long neck or twist, with six holes in it, and perhaps two or three keys at most, so that, being held with both hands, it might be played on in the same way as a clarionet, or with the same fingering as that instrument or the German flute, and without alteration of the mouthpiece.

I am, Sir,
Your obedient servant,
R——.

ANSWERS TO INQUIRIES.

NO. 96.—WATER-WHEEL.

SIR,—In answer to G. B. K.'s inquiry, in Number 96, of your Magazine, concerning a Water-Wheel for a weak stream of water, I would say, that the one he proposes, if not of the very worst construction that could be thought of, is, to say the least, nearly so.—In all cases where the stream of water is very limited, recourse should be had to gravitation, not to impulse, nor partly one and partly the other, as proposed by G. B. K.; but, even in that case, the proposed construction is erroneous; the row-head ought to be a portion of a parabola, so as to lead the water as perpendicularly on the tangent of the wheel as possible, and the float-boards should be so placed that the water at the point of contact may strike them at right angles. But to make the most of the eleven feet fall and weak stream of water, let a balance bucket-wheel be applied, ten feet ten inches diameter, the buckets not to exceed six inches in depth, introducing the water about one foot from the highest part of the wheel. Let the machinery attached be so constructed as to allow the periphery of the wheel to pass through four feet and a half per second; the width of the wheel to be regulated by the quantity of water that can be applied.

For a complete elucidation of the subject by actual experiment, see "Smeaton on Water-Wheels."

I am, Sir,
Yours respectfully,
G—— A——.

Bankside, 27th June, 1825.

NO. 107.—CONSTRUCTION OF CYLINDERS.

SIR,—It is shown by writers on mechanics, that the relative lateral strength of any homogeneous substance, to resist a fracture, is in the proportion of the area of the section at the place where the force is applied, multiplied by the distance of the centre of gravity from the line or point where the breach will end (supposing it actually to break). This rule, applied to the solution of Mr. Tenrule's question, No. 107, is as follows:—Let the thickness of the metal be denoted by x; thus $3+2x=$ the external diameter of the hollow cylinder, which squared is $9+12x+4x^2$, from which subtract 9, the square of the internal diameter, and we have $12x+4x^2$ for the area of the ring; this multiplied by $\frac{3+2x}{2}$ (distance of the centre of gravity from the place where the breach will end), $= \frac{36x+36x^2+8x^3}{2}$, which, by the ques-

tion, $=1 \times \frac{1}{2} = \frac{1}{2}$; therefore $x = .027$ inches, the thickness of the metal required. But here it must be observed, that this rule fails when the metal is under a certain thickness, as the cylinder would then become flawed, and break with the smallest weight. The fact is, this reasoning is founded on the supposition that the figure of the section always remains circular, and will therefore only hold true under those limits in which the pressure upon the tube will not cause its section to change into another figure. Whether our tube falls under these limits or not, experiment only can determine, but it is very probable that it does not, as .027 of an inch is extremely thin.

In the above calculation I have considered both cylinders as composed of one kind of metal, which does away with the necessity of referring to tables on the relative strength of different metals.

I remain, Sir,

Your most obedient servant,

WILLIAM LAKE.

Balbourne.

NO. 133.—CONSTRUCTION OF BEE-HIVES.

SIR,—In your last week's publication there is an Inquiry, No. 133, "Construction of Bee-Hives," requiring information as to the best method of constructing, arranging, and sheltering flat hives, and the most proper time for depriving bees of a part of their delicious food?

As a practical apiarist, I beg to offer the information which my experience leads me to suppose the method best calculated for the management of bees in this country, with a view to their making the best return for the capital employed.

For the construction of flat hives we have ample directions from Huber (to whose indefatigable researches we are indebted for a complete key to the management of this valuable insect); but, as such a construction of hive is not congenial to the habits of the bee, nor do I think (except for experiment and instruction to the naturalist) they are suitable to our climate (which, by-the-bye, is what your Correspondent complains of), or fit to defend the inhabitants properly from the rigour of winter, I therefore rather approve of the common dome-topped hive in use in this country, first, because in its shape the bees are able to construct their combs in the best possible form for affording a safe retreat in the most severe winter, at the same time that their store-combs are within their reach without unnecessary exposure to cold; next, with these hives, a person having confidence in handling them, may appropriate to himself as much of their annual produce as can be spared without killing the bees, which, in every instance, must be a certain loss.

I have not had much time to spare for attending them, but have been able to take of their produce, in one year, 380 pounds of fine honey when my stock was 20 hives, saving alive double swarms in 10 hives for the winter; and as we know that bees do not live for two years, this is a strong argument in favour of saving them alive, and, from populous hives, the greatest advantage is reaped by early swarms in the following spring.

We cannot contemplate their beautiful work without wonder and delight; we even see that the angle at which the cells are formed on both sides of the comb of the common working bee, is that degree which fits them for holding the *greatest possible* quantity of their precious store. Let us husband our resources, save the lives of the little labourers, and look to future rather than immediate gain from their industry; resting assured, that being for a time contented with sharing a part, we shall ultimately have a tenfold return. Little farmers might well pay a small rent from the produce of their apiary.

I recommend the following method of taking the honey:—In the early part of September ascertain the weight of each hive; those weighing upwards of 40 pounds are fit to live through the winter and to support two swarms; even 30 pounds might be sufficient to support a swarm, but all at and under that weight might be taken, and all heavy ones also. Having determined on the number to be taken, and on those to be left alive, place the hive to be taken on an empty hive, inverted, binding them round with a cloth, to prevent the escape of the bees; then let the full hive be turned upside down, and beat the sides with small rods till the bees shall have ascended into the empty hive, which will be accomplished in 10 or 15 minutes; then place the hive in which you intend they shall live for the winter on their stool, with a cloth spread down in front for a path, and the hive raised about an inch, for the reception of the new company; then, with a smart shake between your hands, let the whole swarm (which you have driven up into the clean hive) fall on the cloth. They immediately begin to ascend (very few venturing to fly), and, while they are so ascending, you are to secure the queen bee; her removal will cause them to unite, whereas, if the queen is allowed to enter, the two queens must fight, and there is danger of losing both, besides great destruction amongst the common bees. The queen bee is so conspicuous that it is easily done. The honey may be removed to a little distance, and if there are any bees left, they may be brushed off with a feather, and they will find their way to their companions. I had 90 pounds of fine honey in one hive, the produce of a first swarm from a hive (drilled, as I term it) in this way the former year.

Besides the common working bee, I have had every description of humble bee, and even wasps, working in hives in my garden.

I have, I fear, encroached too much on your valuable pages; if, however, this reply is satisfactory to your Correspondent, and that it will be the means of increasing his store, I shall be gratified.

I remain, Sir,

Most respectfully yours,

J——.

June 28th, 1825.

CORRESPONDENCE.

Communications have been received from A Tinman—G. R.—C. D.—A Member of the Bolton Mechanics' Institute —T. M. B.—Mechanicus—Perseverantia — A Constant Reader — A Carver and Gilder—O. F. F.—J. R. (Hythe)—Mr. Wightman—Sir J. Senhouse—A. B. S. —Mentor—Isis—D. Z.—A Journeyman —Plummet—F. White.

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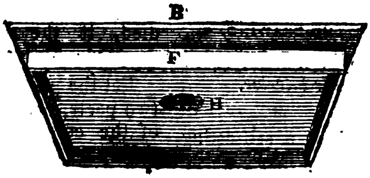
Mechanics' Magazine,

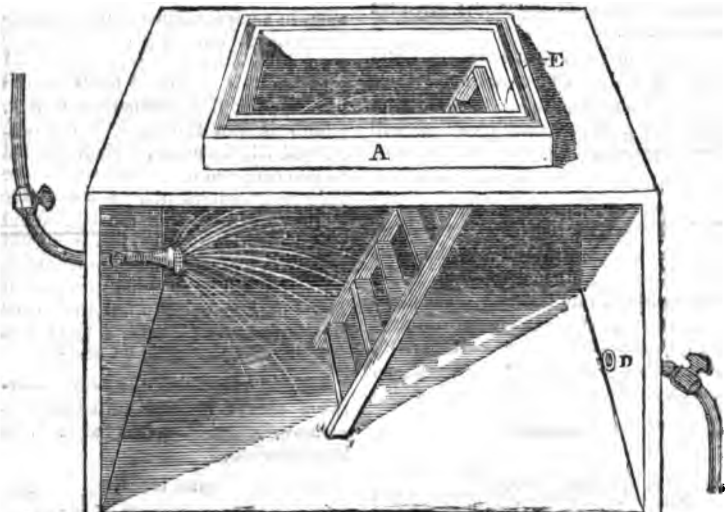
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 99.] SATURDAY, JULY 16, 1825. [Price 3d.

"All that we now deem of antiquity was, at one time, new; and what we now defend by examples will, on a future day, stand as precedents."—*Tacitus.*

PLAN OF EXTINGUISHING FIRES ON BOARD SHIP.





PLAN OF EXTINGUISHING FIRES ON BOARD SHIP.

Sir,—I am of opinion with your Correspondent, J. B., in a late Number, that some effectual means ought to be provided in ships to prevent the recurrence of such a fatal disaster as that which befel the Kent East Indiaman; but I much doubt if water, sufficient to effect the extinction of flame proceeding from any considerable quantity of burning spirit, could be conveyed to the part on fire in the way J. B. proposes.

I herewith send a drawing, to explain a plan, which you will perceive is founded upon the principle, that air is necessary to support combustion.

I am, Sir,
Your obedient servant,
Robinson Crusoe.

EXPLANATION OF THE DRAWING.

Spirit-room of a Ship, one side taken away, to show the interior.

A, the hatchway.

B, the hatch: in it is a self-acting valve, H, to readmit air.

E, a channel to receive the rim of the hatch, F, which drops loosely into it, and forms an hydraulic joint, when filled with water.

The spirit-room must be air-tight, and lined with sheet copper or iron.

C, the injection-pipe, connected with a forcing-pump.—The ship's engine will answer the purpose.

D, a pipe leading to the well.

Suppose the interior of the room to be in flames; the hatch being put on, all communication with the external air is cut off, and the fire extinguished. Water is now forced into the room through the injection-pipe, C, which, condensing the rarefied air, allows the valve, H, to open, and the water to pass off by the pipe, D, into the well of the ship.

STEAM NAVIGATION.

Sir,—As Steam Navigation has lately become of great national importance, any contribution towards its improvement, however small, may be considered a desideratum; it is with this idea that I venture to submit to you a few remarks on the subject. All your Correspondents that have written on this subject hitherto, strongly object to the use of paddle-wheels. Now, in my opinion, the fault lies in the mode of constructing and applying them, and not in the paddle-wheels themselves, as I will endeavour to prove.

The common method of applying paddle wheels to steam vessels, is to place them close to their sides, by which their power of propelling the vessel is considerably retarded, by the quantity of water the vessel displaces constantly running to restore the equilibrium; add to this, the effect produced by the ridiculous practice of crowding a number of floats upon the wheels, and the loss of power must be considerable. I think these evils might be remedied, if the following plan were adopted:—

Let the paddle wheels be made in two parts, each two-thirds the width of the common ones now in use; each part to have four floats fixed to it, at right angles to each other; let these two parts be fixed on the shaft, about three feet from the vessel's side, in such a manner that the floats shall be at an angle of 45 degrees from each other, by which means I imagine the paddle wheels would lose none of their propelling power, which is not the case at present. Should I be in error, I shall be glad to be corrected by any of your more able Correspondents. I am aware it may be said, that the additional width of the paddle boxes would make the vessel appear cumbersome; but as I think it must be allowed that steam vessels do not, nor ever can, appear handsome, I hope this will not be considered an obstacle.

Should you think the above worthy a corner in your valuable miscellany, your insertion of it will much oblige,

Yours truly,
R. Farley.

Rotherhithe.

ON THE USE OF THE SLIDING RULE.

(*Continued from page* 180.)

PROBLEM IX.

To find the solid content in feet, &c. of any piece of square or four-sided timber.

RULE.

Set the length on C to 12 on D; then against the quarter girt on D is the solidity or content on C in feet and tenth parts of a foot.

NOTE.

In order that the workmen may not be led into an error respecting this rule, it will perhaps be necessary to explain what is mentioned respecting the quarter girt, which is generally understood as that of a quarter of the length of a line that measures round the piece of timber; but the quarter-girt here mentioned is a geometrical mean proportional between the mean breadth and thickness, or it is the square root of the product of the breadth multiplied by the thickness; and it has been very properly observed by Hutton, in his Treatise on Mensuration, that unskilful measurers use the *arithmetical* instead of the *geometrical* mean, that is, half the sum of the breadth and thickness, which is always attended with error, and the more so as the breadth and thickness differ from each other.

We may here also observe, that if the piece of timber is tapering, that is, larger at one end than at the other; if it tapers regularly, we may measure the breadth and thickness at the middle of the log, and if it does not taper regularly, but is unequally thick in some parts, and small in others, we must take several dimensions in different parts of the log, and add them together, and divide the sum by the number of measurements we have taken, which will be the mean dimensions.

EXAMPLE I.

What is the solid content of a square piece of timber, whose length is 14 feet, breadth 1 foot 6 inches, and thickness 1 foot 3 inches?

First, then, we have to find the quarter girt, that is, a mean proportional between 18 and 15 inches. Then, by Problem v., the quarter girt is 16.43 inches, nearly.

Now per Rule.—Set 14 on C to 12 on D; then against 16.43 on D is 23 on C, very nearly, which shows the log to contain 23 solid feet.

EXAMPLE II.

What is the content of a piece of timber, whose length is 18 feet 6 inches, and quarter girt 19 inches?

Set 18·5 (equal to 18 feet 6 inches) on C to 12 on D; then against 19 on D stands 45 on C, very nearly.

PROBLEM X.

To find the solidity of round or unsquared timber.

RULE I.

Set the length on C to 12 on D; then against a quarter of the mean circumference on D is the content on C.

EXAMPLE I.

What is the solid content of a tree whose length is 24 feet, and mean circumference, or girt, 12 feet?

Here the quarter girt is 3 feet, or 36 inches; therefore set 24 on C to 12 on D, then against 36 on D is 216 on C, the content required in solid feet.

NOTE 1.

We must always look for the quarter girt in inches, and not in feet, on D.

NOTE 2.

This rule commonly gives the answer about one quarter less than the true quantity of the tree, or nearly what it would be after it is hewn square; which being the common method in use, seems to be intended to make allowance for the waste in squaring—the value of the chips or slabs that come off being not much more than equal to the labour in squaring; but if greater nicety is wanted, the following rule will be found to give the content very near the actual truth.

RULE II.

Set double the length on C to 12 on D, then against 1-5th of the girt on D is the content on C.

EXAMPLE II.

What is the content of a tree whose length is 17½ feet, and girth 15 feet?

Set 35 (the double length) on C to 12 on D, then against 36 (the 5th of the girt in inches) on D is 315, the solid content on C required.

NOTE.

The same remarks will here apply to round timber, with respect to their being tapering or irregular, as were noticed in speaking of squared timber.

G. A. S.

(To be continued.)

POLISHING OF GRANITE.

The most suitable substance for giving a fine polish to granite, is the powder of corundum. It is mixed, not with wax, but with lac, and the greater the care taken in effecting the mixture, the finer and more durable is the polish. It is essential that the powder employed for this purpose should be extremely hard, and hence that of emery (corundum) is preferred.

PIERCING OF HOT IRON BY SULPHUR.

Colonel Evasin, Director of the Arsenal of Metz, in a letter to Gay Lussac, states the following experiments:—

I placed a bar of wrought iron, about 6-10ths of an inch in thickness, into a common forge, fed by fossil coal, and when it was welding hot I drew it out, and applied to the surface a stick of sulphur 6-10ths of an inch in diameter. In 14 seconds the sulphur had pierced a hole through the iron, perfectly circular. Another bar of iron, two inches thick, was pierced in 15 seconds. The holes had the exact form of the sticks of sulphur employed, whether cylindrical or prismatic. They were, however, more regular on the side at which the sulphur came out, than on that to which it was applied.

Steel bars, formed of old files welded together, were pierced more quickly than iron, and presented the same phenomena.

Cast iron, heated nearly to the melting point, underwent no alteration by the application of sulphur to its surface. The sulphur did not even leave a mark. I took a piece of this cast iron, and fashioned it into a crucible, and put it into some sulphur and iron. On heating the crucible, the iron and sulphur were quickly melted, but the crucible underwent no change.

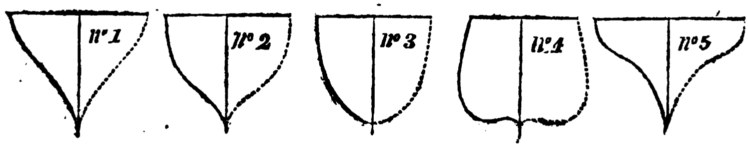
SINGLE BLOCKS OF STONE.

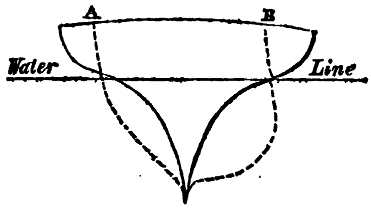
The enormous columns of granite, destined for the portico of the new church now building in the Place d'Isaac, at St. Petersburgh, are very remarkable. In order to form a proper estimate of their size, we will here state the comparative magnitudes of the largest blocks known, both ancient and modern.

1st. The column of Alexandria, commonly called Pompey's Pillar, holds the first rank. It is of a single block of red granite, 67 feet 4 inches 11½ lines. 2nd. The columns of the Church d'Isaac, just mentioned, in height 56 feet. 3rd. The columns whose ruins are near mount Citorio, at Rome, height 52 feet 4 inches. 4th. Columns of the portico of the Pantheon, height 46 feet 9 inches 11 lines. 5th. Columns of the Cathedral of Casan, at St. Petersburgh, height 42 feet. 6th. Two columns of the Church of St. Paul, at Rome, without the enclosure, height 38 feet 4 inches. 7th. The columns near the Baths of Dioclesian, and those of Caracalla, now placed at Florence, near the Pont Trinité, of the same height as the preceding.

To these may be added a beautiful column of white marble, about 40 feet long, taken from a quarry on the south side of the Alps, and now lying by the side of the Simplon road: it was destined by Napoleon for the ornamental improvements of Milan.

NAVAL ARCHITECTURE.





Sir,—Although I think that very much has lately been done for Naval Architecture, yet, as the subject has not been much discussed in your pages, perhaps a few queries relative to it may elicit some improvement.

I think that no material change for the better can be made at once in our ships of war; they must combine so many various properties, that any thing new can only be adopted by degrees in the navy to prevent too great an innovation. My queries shall, therefore, relate to vessels built merely with a view to fast sailing and safety.

1st. What is the best proportion of length to breadth, to have the least resistance in all cases? I myself believe that it is between three and four beams, about 3 1-8th, to the length. A large vessel runs better, but is inferior on a wind, as far as my experience has gone.

2nd. What is the best form of midship-frame, for allowing of the fairest entrance and cleanest run aft?

I have made the prefixed sketches to illustrate my meaning. No. 1 is on the principle of the American schooner (caricatured, that the difference between each may be more obvious). Here the extreme breadth is on deck. No. 2 is, as many of our yachts are now built, the extreme breadth at the water's edge, and the top side nearly upright. No. 3 is the round form, long in use for fishing craft, on many of our coasts. No. 4, the merchant vessel, built to carry more than it measures, and contracted above, that its breadth may not increase the nominal tonnage. No. 5 is that which I consider the best form for sailing.

Here there is great breadth above, and as vessels with a hollow garboard are proverbially stiff, I imagine that the hollow immediately below the surface would give this property in a greater degree, as being farther from the centre of motion. This form would also be extremely sharp in fine weather, that is to say, when the vessel would be nearly upright; but when pressed, the breadth above would support her. I should observe, that the dotted line, A, represents what would be considered a very sharp vessel, according to the usual construction.

It is evident that such a vessel would stow but little nominally, because the breadth above would increase what is generally called the tonnage; yet, upon looking at the waved line, B, which represents the form of a vessel of burden, it will be

seen that the proposed form contains nearly as great an area, while the quantity of materials employed would be nearly in the same proportion. The vessel would be, therefore, much the same size, although, owing to our imperfect method of casting tonnage, one might be called fifty, and the other eighty tons.

It seems also that this mode of construction would allow of a more gradual entrance and a better run, because, under water, the breadth would be so small. Above water, I should be the last to recommend a lean form either of bow or quarter. I think that the bow should flange out much more than ordinary, and that the breadth of the transom should be considerably greater than it is usually made.

3dly. What is gained by the rake of a vessel's stern, and is not the usually required arrangement of it (so that the impulse of the water shall be at right angles to the metacentre)—a mere theory?

4thly. Is a raking stern-post preferable to one which is perpendicular? and why?

5thly. As it is well known that the increase of a vessel's *wooden* keel, although it may keep her to windward, tends to make her crank, may not the same object be attained without this disadvantage, and even with an increase of stability, by placing part of the ballast in an *iron* false keel? This would then allow the ballast to be placed as low as possible within board, without making the vessel roll—a thing which cannot, except in very small vessels, be done at present.

6thly. What is the advantage, exclusive of steering better, which is obtained by building a vessel to trim by the stern? This is, I believe, a characteristic of all fast-sailing vessels, except, perhaps, the French frigate; but I am not acquainted with the reason of it.

7thly. What is the extent to which the curvature of the keel may be carried with good effect? It is a sailor's observation, that a straight keel makes a vessel dead, or labour-some in a sea; and that it also tends to make them slow in stays. This may perhaps be, that the water cannot escape, when pressed by a straight keel's side, as it can, fore and aft, from a curved one.

8thly. Is not the steer of a vessel unnecessary, or rather disadvantageous? When a vessel inclines, the water first reaches the top of her side (even if it be straight) in the middle; and perhaps a contrary method to that now in use might be advantageous. The present mode seems to be derived from the high castles, fore and aft, in the old ships, in which they were used as a place of defence against boarders.

9thly. To what extent may the proportion of the keel to a vessel's depth be safely increased? I think, as far as one-quarter of her depth in hold. As all sharp vessels now use legs, or avoid the ground altogether, the increase of the angle, when aground, seems to be of little moment for a fast-sailing vessel, which cannot be supposed to have a cargo on board. There are few yachts, indeed, now, which would very well bear to be left to themselves to be deserted by the water.

10thly. What weight of iron might safely be fixed to a keel? I think that the keel, being purposely made stout, to bear the necessary bolt-holes, the iron might be put on to the same depth as the keel itself, amidships, and it should gradually run to nothing, a few feet from the stem and stern. I calculate that, in this way, nearly one quarter of the necessary ballast might be placed on the keel.

It must be borne in mind that, even on the ground, this sort of construction would take off much of the strain; because so much weight would be moved from the end of the lever formed by the keel and side close to the ground, which is the fulcrum.

At the present day, any decided improvement in the construction of a fast-sailing vessel would soon find its way into some of the numerous yachts which are now made use of;

and if these random observations should be thought worthy of a discussion, I may, perhaps, extend my remarks to the rigging and equipment of this class of vessel.

I may, perhaps, as well say, that what partial trials I have made of the principles which I have now spoken of, have so far exceeded my expectations, as to make me desirous of the opinion of better judges than myself.

I am, Sir,

Yours respectfully,

PHILO-NAUT.

P.S. I enclose a sketch of a vessel, such as I have hinted at (see the last of the figures prefixed).

UNINFLAMMABLE CLOTHES.

M. Gay Lussac announced, in the sitting of the Academy of Sciences, 6th Nov. 1820, that linen, dipped in a solution of phosphate of ammonia, became incombustible.

M. M. Merat-Guillot, father and son, apothecaries at Auxerres, have since shown, that the acidulous phosphate of lime possesses the same property. In fact, linen, muslin, wood, paper, straw, impregnated with a solution of this salt, at 30° or 35° of concentration (126 to 130), and dried, became absolutely uninflammable, and consequently unfit to communicate fire. They carbonize or char when they are exposed to a very intense flame, but the carbonization does not extend beyond the focus of heat in which they are plunged.

DRAUGHT OF CARRIAGES.

SIR,—As I think your modest Correspondent, M— P—, page 165, is incorrect in his supposition respecting the Draught of Carriages, give me leave to point out what I conceive to be his error. He admits, that when the swinging bar is exactly at right angles to the pole, it may be considered as fixed, and there is no power lost; although, if his principle be correct, there must be loss of power in this case also, for the bar would be drawn out of this direction, if it were not for the power exerted by one or the other horse to prevent it, and which he supposes to be lost. But suppose the power of the horses to be unequal, and that the bar is drawn in an oblique direction, it may then be considered as fixed also, and there is in this case no loss of power. In a lever of the first kind, the fulcrum has to support both the resistance at one end, and the power at the other. In the scale beam, for instance, however one scale may preponderate, still the pivot has the united weights in both bearing upon it. The swinging bar is nothing more than a lever of this kind; and when considered in this light, it must be evident that the point at the extremity of the pole has the whole united forces of the two leaders exerted to draw it forwards. I confess, that I cannot see what advantage would result from the new arangement M. P. suggests, as the pole may be considered as a continuation of the fore traces; and if what I have stated be correct, the leaders now exert their full force on the vehicle.

I am, Sir,

Your obedient servant,

C— S—.

Grove-place, Hackney.

[Our Correspondent requests us to point out some rather extensive work upon Experimental Philosophy, having gone through, two or three times, Brewster's Ferguson, Millington's Epitome, and Dr. Desaguliers. We would recommend to him to read also Dr. Olinthus Gregory's Treatise on Mechanics, Theoretical, Practical, and Descriptive; 2 vols. octavo.]

LONDON MECHANICS' INSTITUTION.

The New Theatre of this Institution was opened to the members on Friday night, July 8th, for the first time, to hear an address from the President, Dr. Birkbeck, and another from Mr. Brougham, one of the Trustees of the Institution. It has been erected on a spot of ground behind the house occupied by the Institution, in Southampton-buildings, and is united to it. The construction of the building does great credit to its designer, Mr. M'William, one of the Vice-Presidents of the Institution. We have seldom seen so small an area turned to so much account in so neat a manner. It is stated to be capable of containing more than a thousand persons, and almost every seat commands a clear view of the lecturer's table. His Royal Highness the Duke of Sussex, the Marquis of Lansdown, Mr. Brougham, Sir Robert Wilson, Mr. Hume, Sir Peter Laurie, Mr. Alderman Wood, Mr. Alderman Key, and several other distinguished individuals, honoured the opening of the Theatre with their presence; there was also a very numerous attendance of members.

ADDRESS OF DR. BIRKBECK.

Amongst the splendid events which, at this astonishing period, occur with rapid succession to exhilarate, encourage, and invigorate the friends of human improvement, the present hour exhibits one of the most prominent and distinguished. We have now assembled to witness the first application, in a complete form, of a vast arrangement, for giving effective accommodation to measures which are destined to fertilize a wilderness of intellect—measures which will combine, hereafter, the power of education, wielded by man, with the power of genius, conferred upon man by his benevolent and omnipotent Author. It will be universally admitted that we live, physically speaking, in a world of wonders; and by him who has studiously contemplated the aspect and the achievements of mind, it will be no less freely admitted that, mentally speaking, we live in a world of wonders also. But, had it been consistent with the general order and arrangement, that cultivation of mind should have been universal, instead of having been confined within certain privileged, but perhaps necessary, and, therefore, unavoidable limits, it is impossible to pronounce to what extent the wonders of intellectual creation might, ere this, have proceeded—that intellect, which, occasionally bursting through the barrier of surrounding difficulties, like the beams of heaven glimmering through the darkness of the storm, has shed its brightness on a few favoured spots amidst the general gloom, instead of pouring out a flood of light, like the orb of day, when, through a cloudless sky, it blazes with meridian splendour. The "Spirits of Knowledge"—those brilliant points discerned in the track of our species—those fertile places in the wide-spreading deserts, forming the mass of human existence, have served but to render the long period of darkness more visible, and the vast regions of barrenness more conspicuous. Of those master-spirits it may, indeed, be said, that, as to their occurrence, they are, like angel visits, "few and far between." But man himself, it ought not to be forgotten, has, for various reasons, in almost every period, strongly exerted his efforts to arrest or circumscribe the development of mind. In all ages there have existed some individuals who have doubted the utility of instructing youth in literature and science, and others, possessing power, who, perhaps, without entertaining the same doubts, have resisted the progress of knowledge. Thus Ælian states that, in his time, letters were considered useless or injurious; thus the Romans treated ignominiously Grecian literature, though they afterwards atoned for this brutality by emulating the pre-eminence of the Greeks in the republic of letters. In like manner, when the barbarians overran the Roman Empire, which had been already ruined by conquests and luxury, and all their consequent evils, they imputed the profligacy and weakness of the conquered to their literary education. This ill-founded opinion (prejudice, I ought rather to call it) spread as the Gothic arms advanced, and became strengthened by the superior discipline and success of the conquerors. At last ignorance became so universal, that Herbaud, the supreme judge of the empire in the 9th century, could not write his name; and even Du Guesclin, the first personage in France in the 14th century, was, according to Palaye, equally illiterate. This state of intellectual darkness has been not unfrequently, in various countries,

protected and prolonged by the exercise of the powers which ought to have promoted their advancement in knowledge. Thus the English Barons petitioned Richard the Second, that no villager (as the labourer was then denominated) should be permitted to send his son to school; and in Peru we learn, from the statement of Garcilasso Della Vega, that it was unlawful for one, not noble, to study. In the reign of Henry the Eighth, also, a Bill was tendered by both Houses of Parliament, to the King, to prevent most of the laity from reading the Scriptures. Among the Turks, a circumstance which cannot create any surprise, the art of printing, we are told by Ricaut, "is absolutely prohibited, because it may give a beginning to that subtlety of learning which is dangerous to their government." And in other countries governed in a similar manner, especially where gross superstition has likewise prevailed, impediments of a similar nature have been discovered. But in all these occurrences there is nothing to excite our surprise comparable with the sentiments of the late Mr. Colquhoun, once the chief magistrate of the most important commercial city of Scotland, of which he was a native, and aware, it might therefore be supposed, of the peculiar excellences of his countrymen, which, with scarcely a dissentient voice, have been ascribed to the extensive diffusion of education. At the beginning of the nineteenth century, Mr. Colquhoun (probably best remembered as the author of a Treatise on the Police of the Metropolis), whilst occupying a seat amongst the magistrates of this great and flourishing city, in a tract on Indigence, has uttered these words:—"It is the interest of every nation, that the people should be virtuous and well-disposed; but science and learning, if universally diffused, would speedily overturn the best constituted government on earth." And to show that it is not to the more refined descriptions of knowledge merely that his objections apply, an assertion advanced in another pamphlet, on the subject of education, may be quoted:—"Utopian schemes for an extensive diffusion of knowledge (he says), without specifying any portion of it, would be injurious or absurd." To enter into a formal refutation of an opinion which has experienced an almost total exclusion from the minds of this enlightened period, would be to contend against the shadow of a shade. I cannot avoid remarking, however, in regard to Mr. Colquhoun's opinion of the texture and stability of the best government on earth, that I believe it to be decidedly false; and that it contains a libel more gross than, in the same number of words, or in any number of words, however large, the greatest libeller of good governments, whether punished or unpunished, has ever yet contrived to utter —(Loud cheers).—From this picture we now turn to look upon that which the wise and noble spirit of these latter times enables me to delineate. His late Majesty, whose long, eventful reign has now become the subject of the historian, will, in the most distant ages, I hesitate not to predict, be gratefully remembered for the liberal feelings with which he patronized and actively promoted the extension of education: and his wish, "that every child in his dominions should be able to read the Bible," will remain an imperishable record of the soundness of his understanding and the excellence of his heart—(Cheers).—The Monarch now seated on the throne of this great empire, I feel, as one of his subjects, peculiar gratification and pride in declaring, has manifested the same exalted liberality. By the honours which he has already bestowed upon some of the most successful cultivators of science, of literature, and of the arts,—upon a Scott, a Lawrence, and a Davy,—he has conferred a signal lustre upon himself and upon the nation, as well as upon them. His regal bounty, also, which has often flowed in a more substantial, and, for many purposes, in a more effectual form, has displayed, by its extent, no common interest in the advancement of the great cause of universal education—(Cheers).—But of the instances of princely regard, which the friends of our country and of education have, with exultation, to record, the most distinguished has been afforded by the illustrious individual who honours us with his presence upon this occasion—(Loud and continued cheers).—I will not permit myself to speak of him in those terms which general opinion would authorise me to employ; because I should become liable to the charge of presumption, and I might also encounter a suspicion which I am at all times most desirous to avoid. I may, however, be allowed to acknowledge the gratification we have received from the kind and warm interest which his Royal Highness has taken in our proceedings, from the first moment that they were made known to him, and for the condescending manner in which he has repeatedly expressed his anxious desire personally to witness those proceedings—(Loud cheers).—This, indeed, might have been confidently anticipated; for very few of the numerous great attempts, which have been made within the first quarter of the nineteenth century, to diminish the wants and alleviate the sufferings of man, or to increase his store of knowledge, have been unaided by the steady, zealous, and eloquent support of the Duke of Sussex. Entering, with unshrinking sympathy, into the wants and

misfortunes of his fellow-creatures, he has seldom failed to be at hand, (loud cheers),

"Wherever man and misery are found."

Of a similar admirable spirit prevailing amongst the Nobles of the land, we have recently had many proofs. The distinguished House of Bedford, through several of its branches, has been a powerful auxiliary to this dignified cause; and the Marquis of Lansdown, the honour of whose presence we have now to acknowledge—(Cheers)—one of whose ancestors powerfully urged the necessity for adopting a more general system of education, as President of the Infant School Society, and as Patron of a District Institution similar to our own, as well as by many other means, has greatly contributed to the attainment of this important purpose. Amongst the Spiritual Lords, it is impossible to overlook the venerable Bishop of Norwich, who thus concludes a letter in which he apologises, on the score of age, for his absence from a recent interesting Public Meeting:—"Every man who has at heart either private happiness or public prosperity, must be a friend to the cause of universal education."—There are several Senators, likewise, to whom the cause of education in general, as well as our particular cause, stands deeply indebted, whom, if time permitted, I should with pleasure enumerate. To Sir Francis Burdett, the great philanthropist, and the consistent advocate of human freedom, we owe many, very many, acknowledgments, for the highly favourable opinion which he has expressed of our undertaking, and for the munificence with which he has confirmed that opinion—(Loud cheers).—To my learned and distinguished friend, Mr. Brougham, for the early, incessant, and irresistible energy with which he has, in every direction, advocated and extended the measures for accomplishing the scientific education of the artisan, we, along with the whole nation, have incurred a large debt of gratitude—(Loud cheers).—Before the demonstrative power of his gigantic mind, opposition has crumbled into dust, and his valuable "Practical Observations" have so effectually confirmed the wavering, and instructed the ignorant, and animated the lukewarm, that Institutions similar to our own have rapidly sprung up, in numbers far exceeding all calculation, and in places where their existence could least have been anticipated. In the formation of schools for imparting the simplest rudiments of knowledge to the infant, as well as in the establishments which give information to youth and manhood, his capacious mind is unremittingly occupied; and although the Bar and the Senate number him amongst the most active, laborious, and enlightened of their members, yet they who mark his efforts, on behalf of education alone, would conclude, that Infant Schools, Lancasterian Schools, Mechanics' Institutions, and a London University, must possess his undivided time and attention—(Loud applause).—Nothing is too minute, nothing too vast or too distant, to be comprehended within his wondrous orbit. And contemplating, as I often do, with silent admiration, the intellectual magnitude by which he is rendered conspicuous among mankind—and the occasional clouds raised by envy and malignity in their unavailing attempts to obscure his brightness—and the splendid halo which, "in records writ by fame," must encircle his memory, I am strongly reminded of a sublime simile, recently and most appropriately applied by him to another subject:—

"As some tall cliff, which lifts its awful form,
Swells from the vale, and midway leaves the storm;
Though round its breast the rolling clouds are spread,
Eternal sunshine settles on its head."

With all this array of rank, of talent, and of power, in the cause of education, its benefits, in the way of practical improvement must be conferred (such, at least, is the inference from the past) somewhat slowly and successively. Even in the great dispensations of Heaven, so essential to the direction and government of mankind, the same rule has been apparent; they have not been communicated at once, and even the most important have been for many ages delayed or withheld. In the same scattered manner, and at distant intervals, have discovery and invention always proceeded. Instead of so occurring, as at once, in the highest degree, to bless mankind, the mariner's compass, gunpowder—a negative blessing, like its counterpart the steam-gun—the art of printing, the steam-engine, the safety-lamp, and the like, were made known in succession. In the same manner, the greatest benefactors of their species were created in times remote from each other, according to those exigencies manifested to the inscrutable mind of Omniscience, in pursuing the wise and benevolent purposes of his government. This procedure has been so beautifully delineated by Dr. Southwood Smith, in his "Illustrations of the Divine Government," that I shall take the liberty of quoting the passage with but little abridgment. "Suppose it is the will of God to lead men to the discovery of the most interesting truths respecting the phenomena of nature, and the laws by which the universe is governed; he endows an individual with a clear and capacious mind; he leads him to observe, to re-

flect, to investigate; he forms him to those habits of patient and profound inquiry which are necessary to elicit the truth to be disclosed, and sufficient to secure him from every temptation to carelessness and dissipation: he arises up a Newton. Suppose that at length he determines to lead back the minds of men to purer sentiments respecting his own character, government, and worship, and to overthrow those corrupt systems of religion which have prevailed for ages, he raises up an individual, whose mind he enlightens, whose soul he fills with an ardent zeal for the simplicity of its rites; who, though cities and empires arm against him, and one general cry of execration and menace follows him from land to land, goes on with undaunted courage to expose abuses, and to call, in a louder and louder voice, for reformation—it is the voice of Luther, which makes corruption rage, and superstition tremble. Suppose it is his will to save a people in love with liberty, and worthy, because capable of enjoying it, from oppression, and to exhibit to the world an example of what the weak, who are virtuous and united, may effect against the strong, who are corrupt and tyrannical—in every season when he is needed, he forms, and in every station where his presence is necessary, he places, a Washington. And suppose it is his will to pour the balm of consolation into the wounded heart, to visit the captive with solace, to extend mercy to the poor prisoner, to admit into his noisome cell the cheering beams of his sun and his refreshing breezes, he breathes the spirit of philanthropy into some chosen bosom; he superadds an energy which neither the frown of power, nor the menace of interest, nor the scorn of indifference, can abate, which exhibits so strongly to the view of men the horrors of a dungeon, as to force them to suspend for a while their business and their pleasures, to feel for the sufferings of others, and to learn the great lessons that the guilty were still their brethren, and that it is better to reclaim than to destroy—he gives to a suffering world the angel spirit of a Howard. Thus, whilst we dare not venture, instructed by the past, to flatter you with the hope, that the system of scientific education to be here pursued, and the systematic application of science to the arts, which will be here unceasingly displayed, will suddenly introduce numerous momentous improvements, we cannot, of consequence, venture to promise that wealth and happiness, in such abundance as may satisfy the ardent desire of man for both, will rapidly result from this important project. We wish only to be understood to maintain the position so admirably expressed by our excellent friend and auditor, Mr. John Smith, "that in proportion as men are rendered intelligent, they will become prosperous, virtuous, and happy" —(Applause).—The large sudden acquisitions of wealth, which have sometimes occurred, I need scarcely remind you, have seldom been observed to bless, seldom even to benefit, their possessors. Fortunate, as the world is accustomed unthinkingly to term them, they are, in reality, like Sinbad in the Valley of Diamonds, walking amidst wealth, but not at all comfortable—(Laughter).—Nor do we profess to banish poverty from those communities with which our projects may be mingled. Improvidence, and the unavoidable casualties attaching to our earthly allotment, will long, if not for ever, maintain great inequalities of condition, and place one portion of the species in painful dependence upon another. We have been sufficiently apprised, that the destiny assigned by the God of Nature, even to the land of promise, is one which expressly includes the certainty of indigence. "In vain," says an eloquent Divine, in reference to this subject, "do all the powers of human sagacity conspire with the energies of pious benevolence to banish this spectre from the world. Expelled from one quarter, it instantly rises in another. It scowls, in mockery, upon all the labours of legislation—it haunts all the dreams of philanthropy—it saddens even the meditations of piety. While we are framing projects for the improvement and comfort of the human race, it stands by with a sepulchral pall, and threatens to spread over our designs the plague of confusion—to clothe our heavens with darkness, and to make sackcloth our covering." To the preservation of health, unquestionably one of the essential ingredients in the cup of happiness, we shall, I trust, by this expedient, somewhat largely contribute. Indirectly, by the substitution of improved habits, and directly, by protecting the operative chemist, mechanic, and labourer, against the pernicious influence of various noxious agents, and against the destructive exertions which mechanical processes, comparatively easy, may supersede—already something has been achieved within these walls for the safety of the chemical artificer; since in the space which you now occupy, effectual, because conclusive, experiments were conducted with the apparatus of Roberts, the ingenious miner—(Applause).—Upon the evidence of these experiments, the Society of Arts granted their liberal reward; and on presenting this reward, our Illustrious Visitor, who so ably presides over that Society, emphatically declared, "that it was calculated to save thousands of lives and millions of property"—(Loud cheers);—thus most impressively and extensively promulgating its excel-

lence. Of the possibility, by mechanical contrivance, of preventing the labourer working out his own destruction, I shall only mention one example, furnished by the coal-heavers or coal-whippers, who ply their self-murderous trade upon the River Thames. Gangs, as they are called, of human beings, belonging to a civilized country, suspend themselves at the end of a rope, in order that their weight, as it descends, may raise another weight attached to the other end. Four sweating fools—(Laughter)—adapting, to our own purpose, the unceremonious language of Dr. Johnson, when describing the amusement of fishing—dangling together at one end of a line, and a basket of coals at the other—(Loud laughter). —Immortal man engaged in counterpoising a coal-basket! It cannot, surely, be much longer endured in an inquiring and an inventive age, that upwards of three thousand men should be permitted to destroy themselves, for want of intermediate machinery, by excessive exertion, and the influence of those mischievous agents by which they are stimulated to endure it. With all our contrivance, however, we cannot shield ourselves against "the arrow which flieth in darkness;" but if we are exposed only to the natural wear and tear of our curious fabric, the ills to which flesh is strictly heir, life will steal on with unperceived decay; and our journey through the Valley of the Shadow of Death, will terminate without its frequently accompanying horrors: the transition again becoming so gentle as to admit, when it occurs, of the re-introduction of the primeval phrase—"He slept with his fathers"—(Applause).—Having contemplated the career of improvement, with the most sanguine expectations as to its results, I could, with great delight, place before you an ample inquiry into the future condition and destiny of man. I am compelled, however, by a recollection of the time which I have already occupied, in a great measure, to desist from this cheering investigation. The voice of prophecy, which has long been silent, is not, as in the infancy of human existence, now required; the voice of experience will enable us "to learn the future, by the past, of man." I will, notwithstanding, so far advert to the coming-in of time, as to remark, that the diffusion of the accumulated wisdom of ages through the uncultivated regions of ill-fated Africa, with the dispersion of our highly instructed operative mechanics, who, delivered from the bondage of ancient legislation, happily now have the world

"All before them, where to choose
Their place of rest, and Providence their guide,"

will, I believe, soon realize the generous hopes expressed by Mr. Brougham respecting that country, in his Treatise on Colonial Policy. "The vast continent of Africa will keep pace with the quick improvements of the world which she has peopled; and in those regions where as yet the war-whoop, the lash, and the cries of misery, have divided with the beasts the silence of the desert, our children, and the children of our slaves, may enjoy the delightful prospect of that benign and splendid reign, which is exercised by the arts, the sciences, and the virtues, of modern Europe." And by the unrestricted intercourse which modern commerce enjoys, rendering the superior attainments of one country transferable to another which does not possess them, the frightful solitudes of the western world will become peopled with activity and genius. Scenes such as have been described in the promising republic of Columbia, by the elegant pen of the philosophical traveller, Humboldt, will then no longer be found. "In America, after having lived," says he, "during several years in the forests of the low regions, or on the ridge of the Cordilleras—after having surveyed countries as extensive as France, containing only a small number of scattered huts, a deep solitude no longer affrights the imagination. We become accustomed to the idea of a world that supports only plants and animals; where the savage had never uttered the shout of joy, or the plaintive accent of sorrow." The treasures of knowledge being thus liberally disseminated through the world, from Zembla to the Line, countless multitudes will quickly become reflecting and intelligent; and a new era in the history of our species will appear, distinguished by the love of peace, the love of order, the love of knowledge, and the love of virtue. Freedom, prosperity, and happiness, will be the great and universal rewards of this melioration, and travelling on, from perfection to perfection, man will at length, however remote the period, justify the declaration, that he is

"Half dust—half Deity."

(Loud and continued applause.)

Mr. Brougham then stepped forward, and thus addressed the Meeting:—"Our learned President (said Mr. B.) has most justly, with the exception of the eloquent phrases which fell from him with respect to me, and which, while they were uttering, I felt must be wholly unmerited by so insignificant a labourer as myself—(No, no, and cheers); but, with that exception, he has most justly, and I am sure most persuasively, eulogized those honourable persons, who, from the highest down to the lower and more middling stations of the whole commu-

nity, have lent their aid to the great objects of this Institution—(Applause);—but there is a person to whom our obligations are so out of all comparison to any other, that they can hardly be placed in the same scale or rank, or be mentioned in the same day; that person is one of whom our learned President could not himself speak, but I am sure he need but be mentioned to obtain respect and gratitude at the hands of all present—for all present cannot fail of recollecting the many debts that are due to him on that score—for the consciousness of his past exertions, and for the happy knowledge that he is now present, renewing those efforts—(Applause).—Of Dr. Birkbeck it is only necessary to say, and of the gratitude that we all owe him, and of the never-to-be-forgotten obligations under which he has laid, not only ourselves, who are assembled here as his friends and fellow-labourers, in a manner, but the whole country likewise, through which he is striving to spread the utility of his labours—of Dr. Birkbeck it is only necessary to say what was said of another great man in a former century—I mean Sir Christopher Wren —" If you seek for his monument, look here around you, and you will find it"—(Loud cheers).—Our gratitude is due to our President; first, because he is the author of Mechanics' Institutions, of General Schools of Art, or by whatever name they may be designated; and next, because he has founded, and carried into effect, this great plan in London, with the assistance and co-operation of those persons who, taking the hint from what he had already done in Scotland, had united for the purpose of circulating and adopting the same system in England, among whom I may more especially notice the authors of the *Mechanics' Magazine;* and lastly, because, when it was founded, not finding it succeed with those honours that it deserved, he became impatient of the slow and tedious progress of general subscriptions, and himself laid down the necessary funds out of which this convenient and beautiful theatre has been raised—(Loud cheers).—To-day, however, he enjoys the rich reward of the great and enlightened zeal with which he has acted, and which has produced so striking a movement throughout the Empire. He has lived to a moment when he may see the system spreading not only generally throughout this island, with hopes of its continuance through every portion of the world, but also taking root in every great place, in every middle-sized place, nay, I may add, in small and obscure villages, in many of which Apprentice Libraries and Mechanics' Libraries are forming, and where even Institutions for study and for lectures have been planted and are flourishing—(Cheers).—With a view to propagate this system, and to enable right thinking men, who agreed in the necessity for such a plan, to afford their assistance towards putting it into execution, I deemed it necessary, some months back, to circulate, as widely as possible, a tract containing these results—(Great applause), made up in a cheap and intelligent form, many thousands of which have been sent not only into large cities, but also into villages; as an instance of which I may mention one small place on the borders of Scotland, where from two to three hundred copies have been circulated among a population which, perhaps, scarcely exceeds five or six hundred, men, women, and children. This, I think, is a sufficient proof how great the prevailing anxiety is for the reception of our principles, and for the adoption of our system. But I have a still better proof—(Cheers);—scarcely three days ever elapse without my receiving a communication of the establishment of some new Mechanics' Institution. At the beginning of May last I made a calculation, that, since the preceding July, had received accounts of no less than thirty-three being established."

The learned gentleman then adverted particularly to the cases of Liverpool, Birmingham, Bath, Leeds, and Manchester, and thus proceeded:—

"Some will tell us that it is dangerous to teach too much to the working classes, for, say they, it will enable them to tread on the heels of their superiors—(Cheers).—Now this is just the sort of treading on the heel that I long to see—(Laughter).—It sometimes happens, I believe, that the heels of these self-nominated superiors are armed with spurs, of no great use, to be sure—(A laugh);—let the toe of the mechanic be also armed with a spur, and I think it will prove a stimulus to the heel of the other—(Much laughter).—It is this that I ventured to predict some months ago in the tract to which I have already alluded, and if those who choose to call themselves our superiors, wish really to have a claim to that title, in order to obtain it I would recommend their more frequent appearance at our parties—(Cheers).—But, that they may have no just cause of complaint, it has been proposed to found an University in this city, which, to its disgrace, has for so many years existed without one—the only one in the whole world that can be so stigmatized, except, indeed, as Mr. Campbell observed on a late occasion, those three seats of depravity, Constantinople, St. Petersburgh, and Madrid, where I cannot say that I have much objection for their enlightened inhabitants to poise their immortal weight against a coal-basket—(Laughter

and cheers).—Now I think that the prospect that I am holding out is a very fair one to save gentlemen's heels from being trod on—(Much laughter);—for, be it observed that they have infinite advantages over us. You are obliged to steal an hour from your mechanical labours, I from my professional only, perhaps as laborious as yours, to come here and listen to the instructions of our tutors. We make a pleasure of business, while they make a business of pleasure; and what follows from the contrast? The labour in which we find ourselves engaged, is of that refined and exquisite pleasure, which they little know who yield themselves to mere brutal and sensual enjoyments, while they hold moral and intellectual ones as nothing—(Immense cheers).—The other argument has been well touched on by our learned President, when he alluded to the exaggerated and unfounded statements of Mr. Colquhoun, who ventured to assert, in the work that has been quoted, 'that if science were taught to the lower orders, there would be an end to the government of the country.' To this assertion my answer is very simple; if, indeed, such a monster of a government does exist in the world as he would make out, the sooner it should cease the better for mankind. I hope it will not be thought that I am speaking seditiously of our own Government—(Applause).—I can assure you that I have no such intention, for it is my firm belief that, so far from science being inimical, the more knowing, the more learned, and the more moral, that the people become, the safer and more sure will the Government be." —(Loud cheers.)

The Duke of Sussex then rose, and was greeted with the most cordial marks of approbation. He said he could not retire from that most interesting exhibition, without expressing himself in the most grateful manner to Dr. Birkbeck, and without looking most sanguinely forward to the good effect that must be produced by the lecture which had that night been delivered; and in taking leave of the company, he begged them to accept his hearty good wishes for the prosperity of the Institution, and to assure them that he should be happy in affording his aid towards its success at all times —(Continued applause).

As our readers must doubtless bear in mind the opinions we at one time expressed of the proceedings of this Institution, it may be well, to guard against misconception, to state whether, and in how far, these are now altered. That it is working to some good, it would be uncandid to deny; the elementary schools, the formation of which was so long unaccountably delayed, have at last been established, and are numerously attended; the courses of lectures, though not regulated according to any systematic plan of instruction, nor paid for as they ought to be, have been, individually, of great merit; a considerable library of books has been formed, and we are told the members have now the free use of them; an excellent collection of philosophical instruments and apparatus has also been got together; and to all these benefits there is just added a most commodious Theatre or Lecture Room. It is still, however, as true, and as much to be regretted as ever, that the Mechanics have, through deception and manœuvre, been deprived of that share in the management, which it was stipulated in the laws of the Institution they should always possess; and the evil which we so much deprecated has been realized, namely, the Institution is deep in debt, and necessarily more dependent on its creditor than it is fitting such a public establishment should be.

We have no wish to depreciate the merit of Dr. Birkbeck: we were the first to make generally known, and have always earnestly asserted, his claims on the gratitude of his country, for opening the Temple of Science to the artisan; but we must, at the same time, humbly contend, that the measures he has taken, or concurred in, to forward the prosperity of this particular Institution, have been more to the honour of his liberality and good nature than of his judgment and resolution.

When Dr. Birkbeck offered to join us in our efforts to establish this Institution, these were his words:—"Of that part of your proposal which relates to *the contributions of the mechanics*, I do entirely approve. Whilst science was to them of doubtful value, it might be offered, as was formerly the case, gratuitously. But its worth, in the most mercantile ac-

ceptation of the word, is now indisputably established; and it is right, in order that it may be fully estimated, and, in its possession, *be unaccompanied by any feelings of dependence, that it should become their own by purchase.*" Now, have the proceedings of this Institution, since it was established and placed under the direction of Dr. Birkbeck, corresponded with the opinions he thus previously avowed? Instead of the men being encouraged to depend entirely on their own contributions, they have been taught to place their chief hope on the benevolent assistance of the great and wealthy, and to applaud, to the very echo, every announcement of a new subscription from Lord this and Sir that. Instead of all the lectures being paid for, they have all (Dr. B.'s included) been delivered gratuitously (if there are any exceptions, they have not come to our knowledge); and instead of the men building a Hall with their own money, they are now invited to avail themselves of a Hall built for them with money advanced by Dr. Birkbeck. Can we be wrong in saying, that there is, at least, a vast deal of inconsistency in all this? Our friend Mr. Brougham says (by way of apology, we presume), that Dr. B., "not finding the Institution succeed with those honours that it deserved, became impatient of the slow and tedious progress of general subscriptions, and himself laid down the necessary funds, out of which this Theatre has been raised." But it was not, as we have just shown, to "*general subscriptions*" that Dr. B., and those with whom he co-operated, in founding the London Mechanics' Institution, looked forward for the means of its success. Neither can it be correctly said, that it was because of "the slow and tedious progress" of such subscriptions that the Institution did not "succeed with those honours that it deserved." Had Dr. B. been as "impatient" of other things as of that begging system, on which he seems to have placed so much dependence —of the slow progress, for example, of the Committee of Management, in providing the mechanics with the elementary schools, the lectures, the laboratory and workshops, the libraries of circulation and of reference, which were promised to be provided, he would never, we will venture to affirm, have had occasion to pine at either want of success or want of honours. When the Institution was founded, there was such a strong and general feeling excited in its behalf among the mechanics of the metropolis, that we feel perfectly convinced, had not that feeling been damped, and at one time nearly extinguished, by disappointments and discouragements, the *mechanics themselves* might and would have furnished all the means requisite for ensuring it the most splendid success, on the most independent principles. We do not make this assertion on vague conjecture merely; for, in our intercourse with the numerous artisans who interested themselves in the establishment of the Institution, we remember well, that it was one of their most favourite anticipations, that they would, ere long, *with their own savings*, and *with their own hands*, erect such a Temple of Science for the mechanics of the metropolis, as would rival, in size and commodiousness at least, the proudest structures which patrician affluence ever reared. We have at this very time, too, *a proof* before us of what mechanics *can do*, when united and zealous, in the fact of their having subscribed, at once, a thousand pounds to establish a newspaper of their own; and in their declared determination to double and quadruple that sum, if necessary, to ensure its complete success. What reason is there to suppose that they would have done less to erect a Scientific Institution *of their own*, had they seen cause to be equally united and zealous for that purpose?

With all the objections, however, which still exist to the course of management of the London Mechanics' Institution, and however detrimental that management may be to

its *permanent* prosperity, there can be no question that it is, at present, such a school of science as persons desirous of scientific information, at a cheap rate, and not caring *how* or *upon what principles* it is furnished to them, will find it highly advantageous to belong to. We are sorry that it is not what we had fondly pictured to ourselves it would be; but, even as it is, we heartily wish it all success.

THE TWO ELECTRICITIES.

The two Electricities may be distinguished from each other by turning the electric current, as it issues from a point, upon the tongue. The taste of the positive current is acid, and that of the negative current is more caustic and alkaline.

DUCTILITY OF GLASS.

Mr. Deuchar, in a paper read before the Wernerian Natural History Society, gives an account of several curious circumstances connected with the ductility of Glass, showing that the most attenuated threads retain the character and shape, twisted angular or tubular, of the mass from which they are spun, illustrating his remarks by an experiment, proving the passage of quicksilver through the most minute threads.

BELL'S MARINE CRAVAT—SCHEFFER'S LIFE-PRESERVER.

SIR,—Without knowing either Mr. T. H. Bell, who has recommended the Marine Cravat, in No. 95, for June 18, or Mr. Teasdale Bell, who, in your 97th Number, intimates that the cravat is nothing else than "Mr. Scheffer's Life-preserver," I beg to differ in opinion with the latter. Scheffer's preservers are intended to be applied to the body, and not to the neck; and, as Mr. T. Bell says, they are to be inflated by a cock, consequently they have not any compartments, as Mr. Bell's cravat has. My intention, however, is not to discuss the merits of either of these gentlemen, but to beg Mr. Bell, or some one of your ingenious Correspondents, to acquaint me where the elastic gum varnish is to be bought, which he recommends? or, what would be more acceptable, to give me directions how to manufacture it? being purposed to make an experiment directly afterwards.

I am, Sir,

Your respectful servant,

MECHANICUS.

Williams' New Post Office Coffee-room, July 4th, 1825.

CORRESPONDENCE.

The Reply of the "Shipowner," in its present form, is inadmissible. If he will divest it of the gross personalities by which it is at present disfigured, or give us permission to do so, it will be inserted, but not otherwise.

Other notices in our next.

*** Advertisements for the Covers of our Monthly Parts must be sent in to our Publishers before the 20th of each month.

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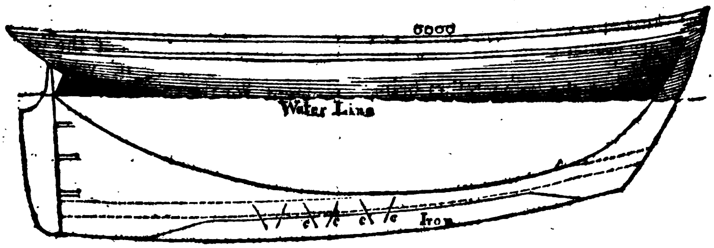
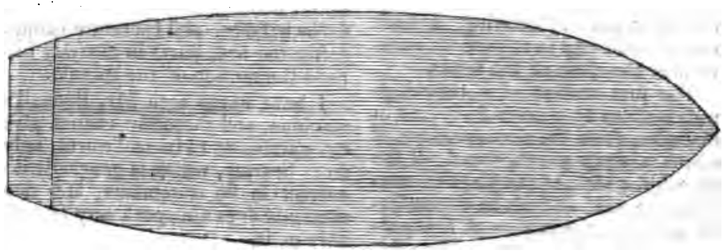
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

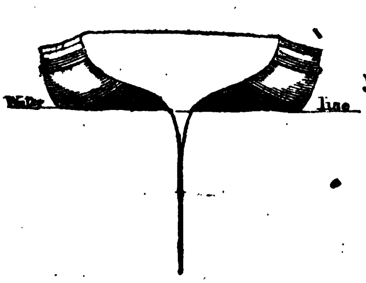
No. 100.] SATURDAY, JULY 23, 1825. [Price 3d.

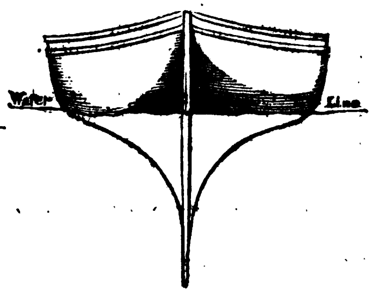
NAVAL ARCHITECTURE.





Deck Plan





The preceding Sketches were accidentally omitted among the drawings illustrative of the article on Naval Architecture, in our last, by Philo-Naut. They are intended to show what, in the writer's opinion, is the best construction for a fast-sailing vessel.

Fig. 1 exhibits the elevation of a vessel; *cccc*, the direction of the bolts.

Fig. 2, the deck plan.

Fig. 3, the stern frame.

Fig. 4, the midship frame.

SILK MACHINERY — BADNALL'S PATENT.

Sir,—In your very useful Magazine of the 2nd of July, I was somewhat surprised at reading a letter signed "A Weaver," from the commencement of which I was led to expect the present method of throwing silk was about to be exploded, and a more expeditious plan introduced, exemplified either by statement or drawing—for what else could be expected, after "the best and most approved machines now in use" are stated to be "clumsy and inferior?"

Instead of the expectation being realized, I found, on farther perusal of the letter, it contained little else than a disapproval of a Mr. Badnall's patent machine, evinced in such language as to give an appearance of a private pique towards that gentleman; and as the author of the same letter seems quite uninformed as to the principal of throwing, I have taken the liberty to answer his questions at the close of the letter.

The first motion of a throwing-mill is given by a drum 36 inches in diameter, from the circumference of which a strap passes round all the spindles, which, at the place of contact, are half an inch in circumference, so that the motion of the spindles entirely depends upon the velocity of the drum. The drum of a mill I have now at work revolves 90 times per minute, which you can easily perceive gives 6480 times to the spindle in that time.

Your Correspondent appears to have made his inquiries amongst those who are little acquainted with the practical part of the operation, when he states the speed of the best spindles not to exceed 500 times per minute. Neither can I suppose him to be much of "a weaver," or he certainly would have observed that the spindles of his own soft silk winding-machine, when turned with moderate speed, do more than exceed double that number of revolutions in a minute. And every one in the least acquainted with the construction of a throwing-mill, must be fully aware that the speed of the latter far exceeds that of the former. With regard to cotton or worsted, I do not profess to be at all acquainted; but as silk is certainly the finest and strongest texture, and also the longest staple, I should suppose it able to bear quite as much or more strain or jar than either of the other substances.

As respects the wheels on Mr. Badnall's plan, I do so far agree with your Correspondent, that the velocity with which they are said to work must very soon destroy them; yet, if they perform what the patentee asserts, the renewal of the wheel will not be a thing of very great moment, for the spindles, if of hardened steel, will outlast many sets of wheels.

I see no difficulty resulting from each spindle having to carry round a bobbin of three or four ounces; for, if that bobbin is placed on the spindle, with a hole through the centre, as all bobbins are, it must act as a fly or balance, and therefore cannot (after the first start) in any way impede the motion of the spindle.

I have never seen Mr. Badnall's machine, and therefore cannot give any opinion as to its real worth, only from hearsay, which is generally incorrect in its statements, and that certainly does not speak very favourably of it.

I would beg to observe, that the mill I speak of does not always turn with the velocity above-named, nor will all silk bear such speed (some not more than half), but it is always attainable when required.

I remain, Sir,
Your obedient servant,
A. B. S.

IMPORTANT INVENTION IN GUNNERY.

Sir,—I have to inform you of a newly-invented gun, for which a patent is now being taken out, and which has been so approved by every individual who has had an opportunity of seeing it, and especially by high authority (even the Duke of Wellington himself), that, if it

meets with the approbation of the military institutions at Woolwich or Chatham (I forget which), it is to be immediately recommended to the adoption of the army. The inventor is a Mr. Downing, a Lieutenant in the Navy, residing at the town of Bideford, in Devonshire. He first invented it for his own private shooting, but, having shown it to some friends, they were so struck with it, that, by their recommendation, he went to London, and is now taking out a patent for the same. I have not seen the gun, nor will the inventor (now) let any body see it; suffice it to say, that he has made a fowling-piece weighing altogether but three pounds and a half, and a soldier's musket weighing only seven pounds. There is no wood used in the construction of any part of the gun, not even the stock, which, from what I can collect from the information of the inventor himself, is made entirely of iron. The stock is a skeleton one: the lock of the gun is in the centre of that part of the stock next the barrel: the cock or hammer of the gun is calculated both for the flint and detonating systems, or both of those methods can, by the simplest means, be used at one time, the hammer descending and letting off the gun with flint, and steel, and detonating powder, at the same instant. Copper caps are not used. The inventor says, that the guard of the gun-lock is at the same time its main spring. The gun is water-proof—the inventor has loaded it, put it in water for a day, taken it out, and fired it off as well as if he had only loaded it the minute before. The gun may be either single, double, or treble barrelled, or even four-barrelled, which four barrels are all let off with the same lock without any extra trouble, and, if required, all at the same moment, or regularly one after the other. The bottom of the barrel, near the touch-hole, is bored conically, so that the point of the cone is the touch-hole. I believe a soldier's musket is generally about fourteen pounds weight: the inventor will take a musket-barrel, and finish it after his new invention, and the gun shall, when complete, weigh only seven pounds. The invention is admirably adapted to pistols, which the inventor says are the lightest, most elegant, most useful, and most beautiful things of the kind ever put out of hand. These guns and pistols are of very handsome appearance, when inlaid and well finished: they carry to an astonishing distance. They will be before the public in little more than two months, when they will be enabled to judge for themselves of their merits.

I am, Sir,
Your obedient servant,
A Sportsman.

WORKING STEAM TWICE.

Sir,—I have had various disputes with my fellow-workmen on the principle of Wolf and Edwards' steam-engine, in which the steam is worked twice over, first at high and then at low pressure. Now I wish to be informed (and I hope the first engineers in the country will not deny their assistance in answering the inquiry) how the steam, after leaving the high pressure cylinder, gains its power to act on the low pressure one? Will not the steam, leaving the high pressure cylinder, have as much power to resist the return of the high pressure piston as it will to give action to the low pressure piston? If so, its double action is certainly of no use; to me it has always appeared so. If I am right, how strange it is that men of acknowledged talent should be found putting upon the world so complicated, so expensive, so delusive a machine! How, I will ask, is it possible, after working the high pressure cylinder to the full extent of the pressure of steam in the boiler, to gain another ounce of power?

I am, Sir,
Your constant reader,
F. J——k——n.

No. 5, Mason-street,
Westminster-bridge-road.

HINTS FOR PREVENTING THE EXPLOSION OF FOUL AIR IN COAL AND OTHER MINES.

The following paper, containing Hints proposed by Sir Joseph Senhouse, Knt., for the purpose of expelling or suppressing the Fire and Choke Damps, so injurious to Miners, communicated by Joseph Huddart, Esq. F.R.S., to the Royal Society of London, was read on the 7th of July, 1810:—

"The mischief that has happened in coal mines, in consequence of the explosion of inflammable air, has sometimes been of so destructive a nature, as deeply to interest the feelings of every benevolent mind. Reflecting upon this deplorable subject, and considering, that whoever can point out a method of mitigating the power of foul air, so as to prevent the recurrence of such disasters in future, will be entitled to the thanks of his fellow-creatures—it appears to me, on deliberating this most momentous subject in my mind with attention, that there is a probability of effecting so desirable an object by means of *irrigation*.

"It is well known, that when a deep well has long been closed, and it is intended that it shall be cleaned out, or repaired, it is customary with those who are aware of the bad effects of the deleterious vapours that may be found at the bottom to throw down a quantity of water; after which a labourer may descend to his work with safety.

"Upon this principle, I am of opinion that the foul air of coal or other mines may be deprived of its power of explosion, by a similar process, in attending to the following hints.

"I would recommend a fire-engine, capable of being worked by four or six men, to be used where the foul air is perceived, and another person to point the pipe. This engine should be built upon four wheels, for the more easy conveyance of it from place to place. When at work, I think the director of the pipe should chiefly aim at the roof of the mine, and endeavour to cause the water to fall down, as much resembling a shower-bath as he can. Supposing the pipe is furnished at the end with a perforated nozzle, like that of a common watering-pan, it will, perhaps, answer that end better.

"A large portion of the mine may be thus watered in a few hours, and I presume the air contained therein will be found much purified by it, the danger of explosion prevented, and be the happy means of saving a number of valuable lives.

"As it possible a sufficient quantity of water may not every where be procured, it may be let down from above, in the nearest shaft, and from thence conveyed to the engine.

"This operation, performed as often as may be thought necessary, I trust, will render those dark abodes much less destructive to human life than they are at present.

"As a corroboration of my system succeeding, when put in practice, I am informed by those who have explored the mines in question, that the foul air is never observed to generate under porous roofs, or where the water falls down in continual drops.

"Another, and probably a more effectual method of expelling foul air, or at least of rendering it less obnoxious to the workmen, may be by ventilation, *i. e.* by forcing down a quantity of atmospheric air to the bottom of the pit, by means of a powerful cylinder-bellows, through a tube of iron, and from thence conveyed, by a leathern hose, to any part where the air is inflammable.

"It seems to me not altogether impossible, that the very same engine which draws water out of the pit, may be so contrived as to be occasionally applied to the purpose of ventilating the coal-works below.

"If a trial of only one of the abovementioned methods should be thought insufficient for the purpose, I apprehend the operation of them both, either alternately or at the same time, will render that destructive air very inoffensive.

"As I consider the coal trade, in every point of view, of very great national importance, I have therefore presumed, in few words, to offer some hints upon the means of procuring that fuel in the pits with safety to the colliers; and should they be thought worthy of trial, and found to answer my expectations, in rendering the air confined in those mines less pernicious than they have hitherto been, I shall be happy on reflecting that I have, in some measure, promoted the public good as well as benefitted the cause of humanity.

"JOSEPH SENHOUSE.

"Whitehaven, May 15th, 1810."

Sir Joseph Banks, then President of the Royal Society, informed me, afterwards, that my hints were favourably received by the Members of that Board; and, as to himself, that he so far approved of my ideas, that he would certainly have a trial made if he had any mine infected with foul air.—J. S.

PYROMETER.

Mr. Macome, in his Lecture on Caloric, to the Johnstone Mechanics' Institution, observed that, several

years ago, when steam was first introduced into spinning-mills, for the purpose of heating them, they had specimens of the Pyrometer on a most magnificent scale. With a laudable attention to economy, the hollow cast-iron pillars which supported the several floors were made a double debt to pay, by serving as pipes for conveying the steam; the consequence was, that each pipe, when thus employed, became expanded by the heat; and although the effect was not very remarkable in the lower floors, yet, when the building consisted of five or six floors, the upper one, with all its complement of spinners, spinsters, and jennies, daily rose and fell through a considerable space.

DIFFERENCE IN THE APPEARANCE OF OBJECTS WHEN VIEWED AT HIGH AND LOW WATER.

Sir,—Sitting, a few days ago, with a party, enjoying the delicious and *forbidden* fry at the Ship at Greenwich, the conversation turned upon the cause of an appearance which had been constantly remarked there, namely, that whenever it was high water, objects on the Isle of Dogs, whether animal or fixed, appeared to exhibit more of their parts in height and more brilliantly than the same objects did when viewed at low water. Much variety in opinion was produced, but nothing satisfactory. Can any of your Correspondents favour us with a solution of what is presumed to be an optical illusion?

I remain, Sir,

Yours most respectfully,

J—— R——.

June, 1825.

BREWING.

Sir,—I shall be greatly obliged if your Correspondent, J— J—, (vol. iv. page 144) will let me know, through the medium of your valuable miscellany, where malt may be purchased that will yield 200 pounds of saccharine matter per quarter? I have, for the last three years, had frequent opportunities of noticing the extract, per quarter, from different parcels of malt, but have not met with any that would produce half that quantity.

I am, Sir,

Your obedient servant,

A Subscriber.

Leominster, July 11th, 1825.

P.S. I have been rather surprised that some of your intelligent Correspondents have not given some instructions on the art of brewing. I am confident, if some *practical brewer* would let the public benefit by his experience, by pointing out the temperature of the water for a first, second, and third mash—the length of time for boiling—and, what I conceive to be more difficult than any other part of the process, the fermentation of the worts, &c. it would be very acceptable to the generality of your readers.

LIGHT, HEAT, ELECTRICITY, AND MAGNETISM.

Sir,—The polite reception given to former communications, encourages me to venture again to address you, and I feel much pleasure in adding my mite towards your laudable endeavours to extend scientific information to the humbler classes of society.

The following facts are very important in their utility, and tend to show the analogies of light, caloric (or heat), electricity, and magnetism, and I hope are, in some points, original. My object will be to prove, that *light is a substance*, and the phenomena of caloric (or heat), electricity, and magnetism, are modes of that substance. It is, I am aware, a venturous effort to overthrow the theory of a Davy and a Wollaston, both of whom have stated their opinion, that light and heat are not material; as also, by inference, electricity and magnetism. It will not be in my power to convey my argu-

ments in one communication; I shall, therefore, from time to time, resume the subject, and I invite candid criticism with a view to my correction.

I shall give, in a tabular form, some, among numerous other, analogies of light, &c. and I hope this arrangement will place the subject in a clearer view, and will be better retained in the mind.

When we consider the vast operations which light and heat are continually effecting in the animal, vegetable, and mineral kingdoms, any ideas, even though founded in error, will tend to sharpen the edge of inquiry respecting these agents.

Light.	*Caloric (or heat).*	*Electricity.*	*Magnetism.*
Emanates from the sun	Ditto	Probably	Violet ray of light produces
Travels with great velocity	Ditto	Ditto	Ditto
Penetrates certain hard bodies	Ditto	Ditto	Ditto
Imponderable, or does not give weight to bodies	Ditto	Ditto	Ditto
Produced by friction	Ditto	Ditto	Ditto
Transmitted in straight lines	Ditto	Ditto	Ditto
Produced by percussion	Ditto	Ditto	Ditto
Produced by condensation	Ditto	Ditto	Force can be compounded
An inconfinable body	Ditto	Ditto	Becomes fixed in a few substances
An agent in chemical decomposition	Ditto	Ditto	Chemical decomposition destroys
Becomes fixed in a latent state	Ditto	Ditto	Perhaps latent in iron
Most intense when accumulated into a focus or point	Ditto	Acts most powerfully on conducting points	Ditto
Produced by decomposition of vegetable and animal bodies	Ditto	Ditto	
Combines with bodies in certain proportions	Ditto	itto	Ditto
Produced by caloric	Produces light	Ditto	Caloric destroys
Produced by electricity	Ditto	Produces caloric	Ditto
Convertible into caloric			
Convertible into magnetism, at least the violet ray	Ditto	Ditto	Ditto
Transmitted by numerous solid and fluid bodies	Ditto	Conducted by some solids and fluids	Pervades every known substance, pure iron excepted
Capable of reflection	Ditto	Ditto	No substance yet known reflects back the magnetic fluid; iron absorbs it
Capable of refraction	Capable of radiation		
Reflected by metals, &c.	Ditto	Conduct. by metals	
Capable of polarity		Ditto	Ditto
Decomposes certain bodies, *per se*	Ditto	Ditto	
Produces prismatic colours		Ditto	
Produces vision	Assists vision	Assists part. vision	Known only by its effects on other bodies, & is unseen
Capable of insulation	by ice	Ditto	Ditto, by pure iron only
Known in an active and latent state	Ditto	Ditto	Ditto
Cause of colours			
Cause of upright growth of plants		Connected with animal vitality	
Acts in vacuo	Ditto	Ditto	Ditto
Produces motion	Ditto	Ditto	Ditto
Excites only one sense, viz.—the eye	Excites the sense of feeling & sight	May be seen, felt, heard, tasted, and smelt	Does not effect any of the senses, and only known by its effects
Cause of vision, colours, perfumes, &c.	Cause of fluidity, decomposition, & evaporation, divisibility of matter, &c.	Cause of lightning, vegetable and animal vitality	Cause of attraction & repulsion, polarity, crystallization, &c.

I do not pretend to have given all the analogies of light, &c. but here are quite enough to warrant the idea of identity; and I do not think it impossible to prove, that all the phenomena of nature are absolutely governed and directed by light, acting in its various capacity of heat, electricity, and magnetism. The very operations of animal and vegetable sensation appear to depend upon these principles, and cannot be explained in the absence of them, as we cannot form any idea, not even an abstract one, of sensation without its cause; and it may simply be stated, for example, with regard to vision—that, do away with light, or do away with eyes (or the sense of sight), and the consequences are the same—the one necessarily depends on the other.

Light and heat have been considered as motion by many respectable philosophers; but it is yet to be explained how it can act, if only vibration, upon the senses of animals, upon animal organs. The sense of touch, which pervades the whole surface, and the interior of animals, or, in fact, wherever there are nerves, cannot be excited, even in the most irritable nervous arrangement, without the actual contact of a material agent (leaving out, for a moment, light, heat, electricity, and magnetism, which are called imponderable bodies). We are susceptible of rough and smooth, soft and hard, round and angular, cold and hot, dry and wet, heavy and light, greasy and sticky, fluid and solid, &c.; but all these varied sensations of the nerves are inseparably connected with parts or combinations of matter; and no sensation is experienced where matter can be denied to be present. The two senses that next depend upon material agency, are those of smell and taste. Hence it is obvious, that their most universal action depends entirely upon the contact of a particular set of nerves, and a particular exciting class of substances. Hearing is produced by vibration or motion; but since it is proved that the auditory nerve would be inoperative in a perfect vacuum, it is hardly necessary to repeat the known fact, that it is the pulsation of the air, acting on an organ and nerve, of such intense and delicate acuteness, which produces sound. Now, if the vibration of a fluid so fine as air, and which is agitated by the falling of a pin, or the hum of a gnat, be enough to stimulate the auditory nerve, it is not difficult to imagine a matter, yet finer (such as light may be supposed to be), acting on an organ of infinitely fine construction; and the difficulty is to get over the fact, that all the other senses depend entirely upon material agents, and yet that vision does not; for if light is mere motion, it is nothing; that is to say, it is not matter.

It is not possible to imagine a nerve to be acted upon by mere motion, or the vibrations of motion; it is absurd and most unphilosophical. The image (or reflected rays of light transmitted from the object viewed) painted on the retina is a real material painting, which acts by vibration on the optic nerve, and it exercises all the properties of material agents, it tires the nerve, and if too long applied, would injure, and eventually destroy its irritability, upon which its function depends. A strong flash of light is as painful to the eye as a smart blow is to the body; the continued action of light, or of any strong object, to the eye, is as injurious and painful as long-continued pressure is to any part of the body. Light has been thought to consist of particles of a certain magnitude; heat, of particles larger; electricity, larger than those of heat; and magnetic particles, of the largest of all, and hence are more confinable than the other three. This opinion harmonizes with the laws of atomic arrangement; and it is easy to conceive the condensation of one, two, three, or four atoms of light, which would produce, so combined, very different degrees of effect, as we see in other forms of matter in chemical arrangements and affinities. The size of the particles of light may be inferred from those of air, by the difference between the velocity of sound and light; for light to vision bears the same analogy as vibrations of

air or sound do to hearing, for it is but by the senses we can estimate things. The velocity of undulating water is to that of undulating air as 865 to 1, or as their specific gravities; the motion of sound is found to be 1130 feet in a second. Now, light reaches the earth from the sun in the space of 8′ 75″ of time; semi-diameter of the earth 3964 miles; sun's real diameter 873,489 miles; his distance from the earth 93,334,047 miles; consequently the velocity of light is 191,434 miles in a second of time, or 1,010,771,520 feet; which would give the specific gravity of light, to that of air, as 894,588 to 1; so that it will require 1553 cubic feet of light to weigh one grain. Water, taken at unity, the specific gravities stand thus:—

Water . .	1,00000000000
Air	0,00120000000
Light . . .	0,00000000013

I am, Sir,

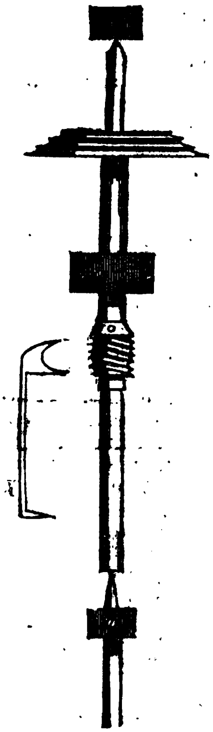
Your obedient servant,

H. C. Jennings.

LATHE AND TOOL USED AT THE ROYAL ARSENAL, WOOLWICH.

Sir,—I beg leave to forward for publication in your useful work, a description of a Lathe and Tool, which is, perhaps, not generally known, though it has been used in the Royal Arsenal here, for many years, to form the thread upon the screws used to bush the touch-holes of the brass cannon with copper vents; and as it greatly assists the workman in forming, or rather copying the screw, in a perfect and uniform manner, it may not be altogether unworthy of your notice.

On that part of the mandril which projects beyond the collar of the lathe, hollow cylinders, of different threads, are occasionally fitted, and a piece of steel is flattened at one end, and worked into a kind of crescent, whilst at the other it is filed into a triangular point, to fit the required thread. The two ends of this tool are now bent at right angles to its centre, forming three sides of a parallelogram; the crescent end being applied to the screw cylinder on the mandril, the cutting point, of course, follows in a similar proportion, and cuts a fac-simile thread on the work submitted to it, and serves to effect an entrance for the screw tool.



The sketch prefixed shows a lathe with a screwed cylinder fixed in the mandril; the side figure is the tool above described, with the crescent ready to apply to the thread, and the point to the work in the lathe. As a modification of this plan will enable a workman to copy any required screw, I trust to your kindness for an early insertion.

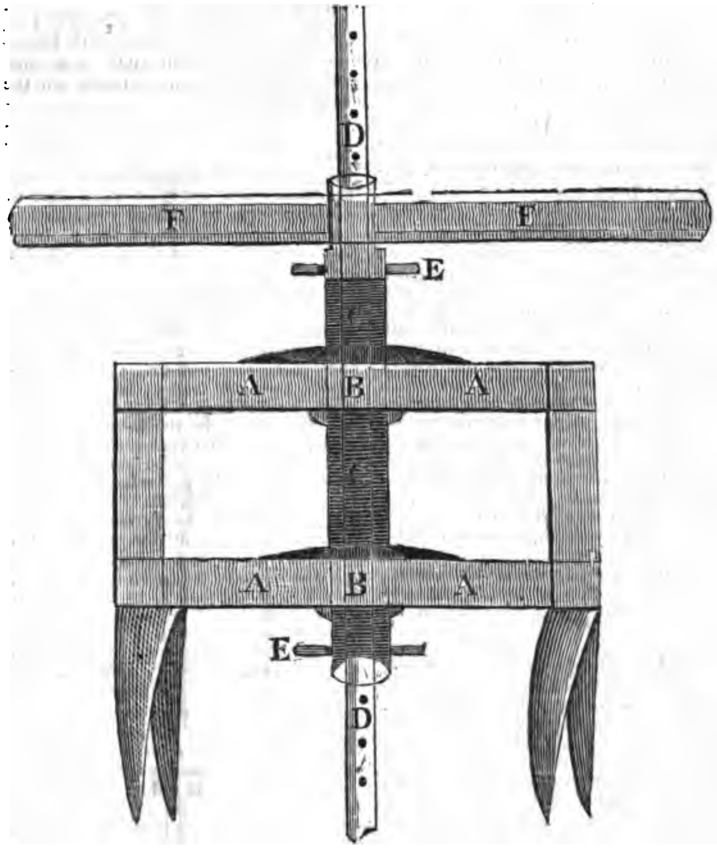
I am, Sir,

Your obedient servant,

A Constant Reader.

Royal Arsenal, Woolwich.

A BORING MACHINE FOR MINES, &c.



DESCRIPTION.

AAAA represent a strong frame of wood firmly fixed to the ground.

BB, two screws fixed in the frame.

CC, a large hollow screw, running in screws, BB.

DD, the centre-bit (or borer), made a half-circle, like a gimblet, with a screw or half-cut on the end, like an auger, with holes in it, represented at DD, for pins, EE, to go through, and likewise through the large screw, CC, to join them.

FF, a lever of wood, 15 or 20 feet long, and fixed to the top of the screw, CC.

OPERATION.

Say one man were placed at each end of the lever, by going round they screw down the screw, CC, and the borer along with it (while the pins, EE, are in), and when it comes down to the frame, they take out the pins, EE, and drive the lever the contrary way, which screws (the screw, CC), up to the pitch again, leaving the borer fixed. Put the pins, EE, a few holes higher, and proceed as before. The borer being a half-circle, and hollow, it follows that the earth and minerals will be forced up at the top, and the borer will be joined piece to piece, in the usual way, as it goes down.

I am, Sir, yours, &c.

J—— M——.

ADVANTAGE OF SCIENTIFIC KNOWLEDGE TO MECHANICS.

We extract the following convincing arguments in favour of the spread of scientific knowledge among the working classes, from the Inaugural Address of Mr. Heywood, the President of the Manchester Mechanics' Institution.

"It has already been stated to you in the Prospectus, that 'the Institution is formed for the purpose of enabling mechanics and artisans, of whatever trade they may be, to become acquainted with such branches of science as are of practical application in the exercise of that trade;' and again, 'that there is no art which does not depend more or less on scientific principles, and to teach what these are, and to point out their practical application, will form the chief objects of the Institution.' Some of you may possibly think, that scientific principles can have little to do with your occupation; that, to learn your business thoroughly, nothing more can be necessary than to be diligent, during your apprenticeship, in your endeavours to imitate the skilfulness of those under whom you work. I will not deny that, by this means, you may acquire great dexterity in your occupation:—it is thus that the Indians, with whom the cotton manufacture originated, produce their beautiful muslins. All the implements they use, in the different processes of the manufacture, from the cleaning of the cotton, to the converting of it into the finest muslin, may be purchased for the value of a few shillings. With the exception of their loom, there exists among them no manufacturing instrument that can bear the name of a machine; nor is there any trace of the Hindoos having ever displayed any mechanical ingenuity. They spin their yarn upon the distaff; the loom upon which their cloth is woven, is composed of a few sticks or reeds, which the weaver, carrying them about with him, puts up in the fields, under the shade of a tree, digging a hole large enough to contain his legs and the lower part of the geer, the balances of which he fastens to some convenient branch over his head. Two loops underneath the geer, in which he inserts his great toes, serve as treadles, and the shuttle, formed like a large netting-needle, but of a length somewhat exceeding the breadth of the cloth, he employs also as batton, using it alternately to draw through the weft, and strike it up. The loom has no beam; the warp is laid out upon the ground, the whole length of the piece of cloth. Upon this rude machine, worked in the way I have mentioned, the Indians produce those muslins which have long been such objects of curiosity, from the exquisite beauty and fineness of their texture.' But mark the other effects of this adherence to the same practice from generation to generation, to which, by their superstition, these poor Indians are bound. In India this manufacture has existed, almost in the same degree of perfection, for some thousand years, yet it has given birth to no inventions, to nothing calculated to improve the condition of the people—those who carry it on are in poverty and abject dependence.

"In our own country, on the contrary, the cotton manufacture, as compared with the ages it has existed in India, is only of yesterday, yet it already constitutes more that one-half of our whole trade; and you may estimate its progress from the fact recently stated by Mr. Huskisson, in the House of Commons, that in the year 1765, the value of cotton goods exported from this country was 200,000*l.*; in the last year it was upwards of 30,000,000*l.* It has given birth to inventions to which we are mainly indebted for our present pre-eminent station and prosperity; and, what is more to the point in this case, which have enabled us to receive from the Indian the cotton which grows at his door, to manufacture it into a shirt to cover him, and to send it back to his own country, and sell it to him, cheaper than he can provide it himself.

"I need not say more to convince you that the undeviating adherence to established practice—the mere imitation of what others have done before—precludes all advancement; it reduces man to the condition of a machine. Skill thus acquired is little better than an instinct, and it has been well observed, that you are as little entitled to expect improvement in such a case, as in the architecture of the bee and the beaver.

"If this course had been pursued in our own country, we might now have had no other mode of spinning cotton than on the cottage wheel—no other mode of bleaching a piece of cloth, than by the tedious process of exposure for months in the open air.

"But if, when you are at your work, you are not satisfied with merely doing what you have seen others do, but try to find out the reason for each operation that passes through your hands, and the principle on which it depends, you are then in the sure way of making improvements in your trade. Nay, if you only *observe* accurately each operation in which you are engaged, you are already on the threshold of improvement.

"Hargreaves, the weaver, who invented the spinning jenny, was first directed to the invention by seeing a common spinning-wheel, which had been accidentally overturned, continue its motion while it lay on the ground. This was the first great improvement in spinning, and it resulted merely from the attentive observation of an active and inquiring, but altogether uneducated mind.

"The ingenious contrivance for regulating the valves of the steam engine, was discovered by a sharp lad, who set his wits to work to see if he could not lessen his own labour.

"Mr. Watt was led to his first improvement in the steam engine from his observations when he was employed to put in order a working model of an engine on Newcomen's construction. He soon discovered some material defects in its principle: one of these defects he remedied before the model left his hands; others he was not at the moment able to account for: his vigorous mind, however, applied itself at once to their thorough investigation. Science, ere long, removed his difficulties, and led him to the invention of the separate condenser; affording you a striking example of the practical application of the principle of latent heat.

"I fear the minute details of the successive steps, by which Mr. Watt proceeded in this, and his other greater improvements of the steam engine, might occupy too much of your time at present. They will be found in his life, and are very interesting: nothing can convey to you a stronger idea of his sagacity, ingenuity, and scientific attainment, or more strongly enforce what I wish now to impress upon you—the connexion of the principles of science with manual labour. There cannot, indeed, be a more beautiful and striking exemplification of the union of science and art, than is exhibited in the steam engine.

"You have another (in two senses of the word) *bright* example of the same union, in the light with which this theatre is illuminated. To the introduction of this admirable practical application of the gas from coal, we are indebted to Mr. Wm. Murdoch. He was first led to his experiments on the subject, by observing the brilliant flame, which you must all have frequently seen issue from coals on the fire at the commencement of their ignition. He pursued his inquiries with great ability and perseverance for several years, by subjecting a great variety of substances to distillation by ardent heat, and carefully investigating their various products; but he made no attempt to carry his discovery practically into effect, until he had, in a great measure, brought it to perfection. In the year 1805 he commenced preparations for lighting with gas the large factory of Messrs. Philips and Lee, in this town (Manchester), in which he completely succeeded. The example was soon followed by others, and how generally it has been extended, and with what beneficial effects, I need not tell you.

"There are two very beautiful examples of the union of science with art in the safety lamp, and in Hall's singeing machine. To the construction of the first, Sir Humphry Davy was led by finding that flame would not, under ordinary circumstances, pass through an aperture less than one-twentieth of an inch in diameter. In the other, by the intervention of a partial vacuum, Mr. Hall has caused flame to pass through the interstices of the finest muslin.

"But I wish to bring more immediately home to you the application of science to your occupations. The mechanic, whose knowledge of his business is confined to the skilful handling of his tools, is in no way of improvement: he must learn also the nature and properties of those materials on which he works—their relative weight, hardness, toughness, strength—the effects upon them of heat, gravity, position, &c.; these involve principles upon which his art depends, and these will be taught him here.

"The art of the carpenter is directed, almost wholly, to the support of weight or pressure, and, therefore, its principles must be found in mechanical science.

"The great improvements in the art of bleaching depend immediately on certain principles of chemical science, which Mr. Watt, and your late venerable and enlightened townsman, Mr. Henry, were the first practically to apply in this country.

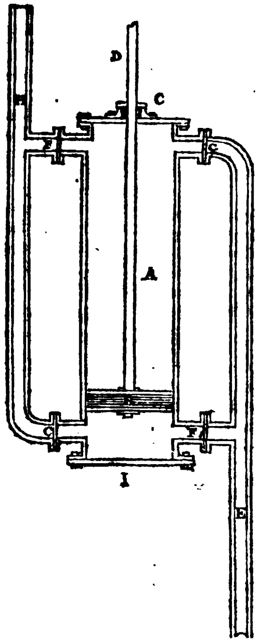
"The improvements in the art of calico-printing and dying have the same immediate dependence on chemical principles.

"These examples may suffice to shew you, that the principles of science are applicable to your business. It matters not what that business is: I have taken my examples from those trades in which the improvements are prominent, but similar reasoning applies to all.

"It is the great object of this Institution to put you in the way of acquiring the knowledge of these principles, and to show you how you may most readily make this knowledge available to your advantage—to remove the difficulties which now obstruct your further advance—to teach you so to *observe*, that your observation may be profitable to you."

DOUBLE PUMP,

[DESCRIBED BY M. OZZANAM.]



Sir,—The annexed figure represents a Pump, described by M. Ozanam in his *Récréations Mathématiques et Physiques* (Paris, 1750), which appears to be much superior to the pumps now in use, though I have never met with a notice of it in any other work. Its action and construction may be easily understood by the figure. A is the working cylinder; B, the piston, or plunger, the rod of which, D, works, in an air-tight manner, through the stuffing-box, C. E is the suction-pipe, or pipe leading from the well; and H, the discharging-pipe. FF and GG are valves, all opening upwards. The piston is represented as ascending, and therefore the valves at FF are open, and at GG shut. I is the plate closing the bottom of the cylinder, and by which the whole may be securely bolted down to the work supporting it. It will easily be seen, that this pump raises water both in the ascending and descending stroke of the piston, and therefore affords a continued stream of water. Pumps with double action have been in use some time, but the one above described is more simple and powerful than those on the usual construction.

I am, Sir,
Your constant reader,
E— A—.

London, 18th June, 1825.

PRIZE CHRONOMETERS.

Sir,—I am induced to trouble you again with a few observations, in consequence of an article in your Magazine, Number 98, headed "Prize Chronometers," although it ill accords with my numerous engagements.

Your new Correspondent, I conceive, steps rather out of his way to charge me with the warmth of temper, which, according to his opinion,

I have exhibited in defending my conduct against the unmerited aspersions that have been cast upon it. How far the honest indignation I have expressed will admit of such a charge, I leave your discerning readers to determine; but I can assure this gentleman, that I shall be governed by no man's advice in regulating the language which I may think proper to use against an individual who attempts anonymously to vilify his neighbour. Nor do I envy any man his feelings, who can tamely suffer his character to be traduced, without exposing the author to the contempt he merits.

This Correspondent, who calls himself a real workman, but not a rival of mine, thinks I am bound in candour to come forward and avow whether I am, or am not, the real maker of all the chronometers which have appeared at the Royal Observatory in my name, that I may thereby silence the complaints of "real workmen." I know of no such complaints. Certain it is, that *none of my workmen have complained*, and with those of others I have nothing to do. But *I must protest against the right of any man to interfere either with myself or my men;* nor do I feel myself bound to answer interrogatories which are manifestly impertinent. It is well known that a chronometer is not the production of a single mechanic, but the result of the combined labours of many: I must, therefore, protest, on general grounds, against the right of any individual workman to claim to himself the honours that exclusively belong to his employer; and if workmen cannot complain individually, they cannot collectively. Moreover, as workmen cannot have their names attached to their employers' machines, they can have no responsibility; and, consequently, it *is he alone who makes himself responsible, and who must bear the obloquy of bad performance, that is justly entitled to whatever credit may attach to the good performance of his machines.* The laws that regulate master and workman are perfectly well understood; it is a voluntary compact, and the moment the workman has completed his contract, and received his wages, he is at liberty to work for another, or on his own account, if he thinks proper. Nay, as the Royal Observatory is open alike to all, he may go and compete with the rest; and, therefore, he can have no just cause of complaint. If, indeed, a case occurred, where a master bound over a valuable workman to work for himself exclusively, such an advantage taken of talent might excite complaint; but as no such case has occurred within my knowledge, I apprehend the object of your Correspondent must fail of the effect which he seems so desirous to produce.—But while my workmen are satisfied with me, I feel no regret in having thus excited the jealousy of those with whom I have no connexion; for their jealousy only proves, that

> "Envy will merit, as its shade, pursue,
> But, like the shadow, prove the substance true."

Your Correspondent wishes farther to insinuate, that I am ignorant of the instrument which the term *chronometer* is intended to express; but had he made himself acquainted with the derivation of the word, he would not have risked such an assertion. Chronometer is derived from χρόνος, time, and μετρω, to measure; and, therefore, every machine for the admeasurement of time is, in the most rigid acceptation of the term, a chronometer. But I am as well aware as your Correspondent, or any other man, that the word *chronometer* is applied by the scientific world to those machines only that measure time most correctly, as box and pocket chronometers, astronomical clocks, &c. Indeed, every machine to which the compensation for heat and cold is PROPERLY applied, whether it be in the balance or the pendulum, may be strictly termed a chronometer; and in the knowledge and experience of this application, as well as every other department of my business, I yield to no man. I would, however, evince little prudence in imparting this knowledge and experience to the public, through any other medium than that of my machines; and I

rejoice to say, that the character which they have obtained for me, has placed me beyond the reach of any influence which jealousy or envy may endeavour to excite against me, and for which I can never feel too grateful to an enlightened and discerning public.

J. M. French.

Royal Exchange, July 14th.

[We are sorry that the above letter reached us a few hours too late to have a place in our last Number. To communications which involve the vindication of character, or correction of error, we make it an invariable rule to give immediate insertion.—Edit.]

VIATOR'S "PERPETUAL PUMP."

Sir,—As the motto of your 93rd Number, and immediately over its frontispiece, "the Perpetual Pump" of Viator, stands the truly philosophical sentiment—"It is always requisite to think justly, even in matters of small importance." Subscribing most fully to the Fontenellean maxim, and perceiving your Correspondent, "Viator," to be in error in this "matter of small importance," I take the liberty of addressing to you a letter, for the purpose of pointing it out.

By the design (and explanation), it is proposed that a sort of box shall be divided into two parts, and placed about the centre upon an axis; one part to be filled with stones, and into the other to run a stream of water (the other end of the box, with the stones in, to be attached to a pump-handle). When the said compartment has a quantity of water in it, greater than the weight of the stones in the other, that half of the box will begin to descend (and, of course, the other to rise), but it will not, as supposed by Viator, *empty* itself; but, on the contrary, only such a quantity of water will flow out of it, as that which remains will have just sufficient power to keep the box in that inclined position, in which *exactly* as much water will run out as runs in, and then the "perpetual pump" must, of necessity, stop; because the two weights will have found the point of equilibrium, from which there is nothing to disturb them. It is true, Sir, that a similar machine, with a valve in the bottom or side, might be made to act (with a supply of water) perpetually; but this Viator does not appear to have thought of.

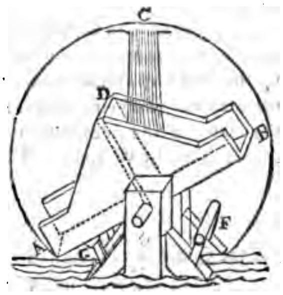
Should you deem this worth inserting in your valuable Magazine, I will describe the nature of the necessary valve, &c. in another communication.

Montis, Jun.

A similar objection has been made by N. H.; but let our readers attend to what follows, from a third Correspondent.

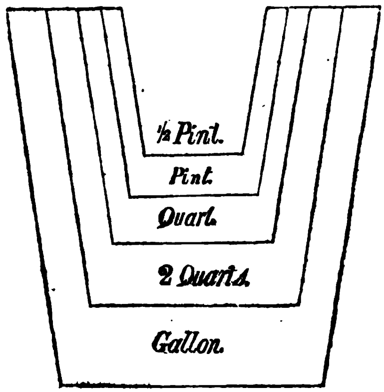
Sir,—In the Analytical Essay on the Construction of Machines, of M.M. Lanz and Betancourt, is described a machine similar to the "Perpetual Pump" in your 93rd Number. I send you a Drawing and Description, extracted from the work.

R. Crusoe.



Water is made to fall, as at C, in the figure, into the vessel, D, which is constructed to turn, or swing on an axis, M, and is divided in the middle into two equal parts by a partition. When the base of this vessel is in an horizontal position, the water falls so as to divide itself equally by the partition beforementioned; and in any inclined position the whole quantity of falling water will be received by that side of the vessel which is elevated. In the position shown by the figure, this entire quantity is received by the side, B, of the vessel; when that side of the vessel becomes full, it turns on its axis in the direction of that side, and descends till it reaches and rests on the stop or support, F, pouring out, by this change of position, the quantity of water which produced the motion. The opposite side fills in its turn, and brings the vessel into its first position, resting on the support, G; and the operation is repeated.

NEW IMPERIAL MEASURE.



Scale one-quarter of full dimension.

SIR,—Mr. W. Lake, in your 95th Number, page 175, has noticed some errors in my answer to T. H.'s problem, in No. 89, page 382. I am ready to admit that the figures in the fifth column are erroneous, from an inadvertence in subtraction, and were discovered to be so soon after the paper was sent, which not being inserted for several weeks, I considered it as being laid aside. The whole of the fifth column being unnecessary, should be erased, because the thickness of the metal of the sides both at top and bottom will be the same, and not different, as given by W. Lake. There are several errors in his answer, viz.—

Diameters.

				Error.
1st, of the Quart	3.4621	should be	3.4613	.0008
	4.9458		4.9448	.0010
2nd, of the Pint	2.7479		2.7473	.0006
	3.9255		3.9247	.0008
3rd, of the Half-pint	2.1811		2.1805	.0006
	3.1158		3.1150	.0008

Of Thickness.

4th, of the Quart	0.6427	should be	0.6426	.0001
	1.2882		1.2852	.0030
5th, of the Pint	0.5102		0.5101	.0001
	1.0203		1.0201	.0002
6th, of the Half-pint	0.4049		0.4048	.0001

Thus, with the exception of the supernumerary column, the errors happen to be all on the side of W. Lake, which he will be able readily to convince himself of, by calculating the cubic contents of any of the above measures by the usual formula: $\frac{A^3 - a^3}{A - a} \times \frac{f\,h}{3}$.

The figure in the preceding page represents the sections of the respective measures, from which it is evident the thickness of the sides, in a direction perpendicular to the axis, both at top and bottom, are alike.

The following is a simple method of calculating the dimensions :—

Let D = top diameter, and depth = $10x$,
d = bottom diameter ...... = $7x$,
C = cubic inches in the vessel,
p = 3.14159, &c.

$$\text{Then } \left(3Dd + \overline{D-d}^2\right) \cdot \frac{Dp}{12} = C$$

$$(210x^2 + 9x^2) \cdot \frac{10xp}{12} = C \qquad 2190x^3 = \frac{12c}{p} \qquad x = \overline{\frac{2C}{365p}}\Big)^{\frac{1}{3}}.$$

$$\text{Therefore } D = \overline{\frac{2000C}{365p}}\Big)^{\frac{1}{3}} = \overline{1.744163C}\Big)^{\frac{1}{3}}.$$

The calculation by logarithms will be thus :—

Logarithm of 1.744163 = 0.2415872
Half-pint....17.329625 = 1.2387891

3)1.4803763

Depth and top diameter of half-pint ....3.1150 = 0.4934588
× .7

Bottom diameter ditto 2.1805

I am, Sir, your obedient servant, B. C.

P.S. The errors above exhibited are small, and would not have been noticed if W. L. had not considered the former answer altogether erroneous.

Some of your Correspondents, perhaps, may give a short and ready method of ascertaining the thickness of a metallic plate, by having its area, weight, and specific gravity. B. C.

CORRESPONDENCE.

Communications have been received from Mr. Matthews—Amicus Veritatis—R. M.—T. Harris—Clio—A Subscriber and Journeyman Carpenter—S. M. A. R.—J. B. C. D.—J. J. M.—Titus—John M.—F. P.—T. H.—A Blacksmith—X. Y. Z.—A Joiner—Stultus—John Williamson.

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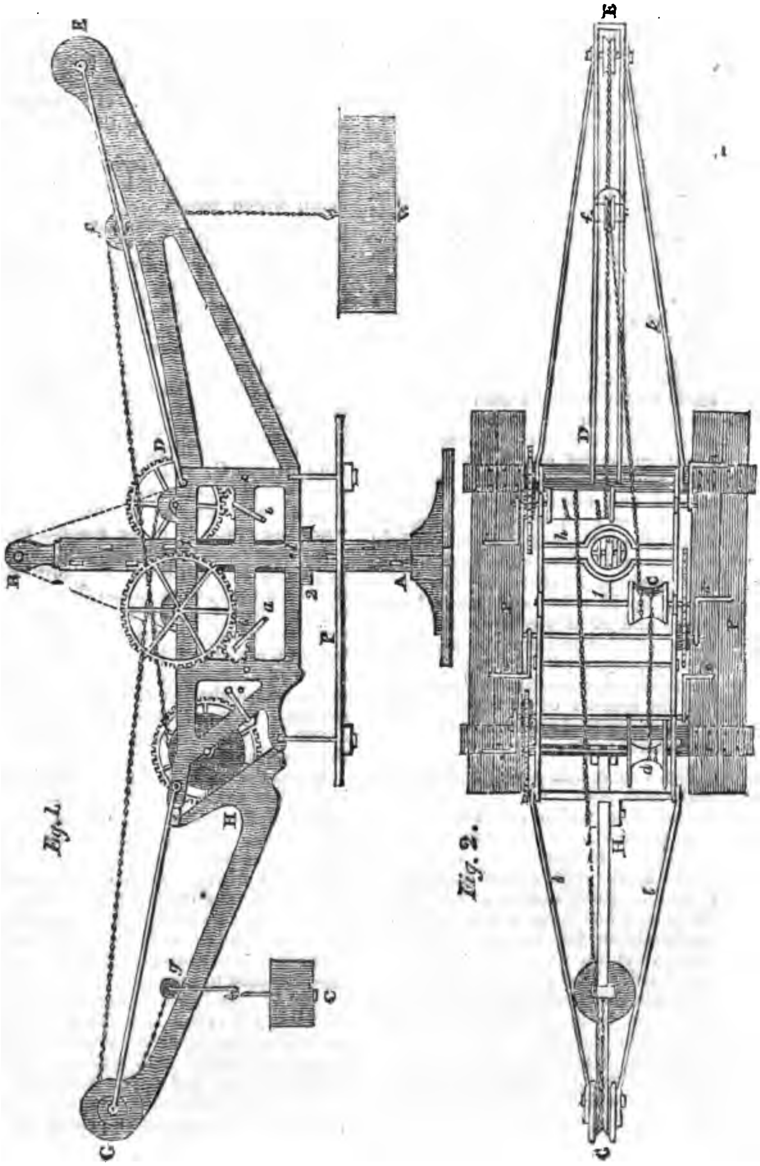
WATT'S COUNTERPOISE CRANE.



WATT'S COUNTERPOISE-CRANE.

We present our readers with an engraving and description of another of those masterly contrivances of Mr. Watt, by the help of which the building of the Bell Rock Lighthouse was so much facilitated (see vol. II. p. 401). The Counterpoise-Crane was invented by Mr. Watt, when the height to which the lighthouse was built rendered the use of gy-ropes to steady the jib-crane no longer convenient, and when the opening in the centre of the building admitted of the crane's having a permanent situation. The patterns of this crane were wholly made under the direction of Mr. Watt, and he went to the Calder Iron-works to superintend the casting; and though, after it had been put together at Arbroath, it was sent to Edinburgh to get some slight alterations (we believe in the barrels *c* and *d*), yet we have reason to think that the hint of these alterations was given by Mr. Watt previous to its removal. This crane, though of great weight as well as power, stood perfectly steady upon its own cross foot, at the same time that it would raise with facility a weight of two tons, and could command any point within a ring beginning three feet from its centre, and extending nine feet in breadth, or even more, if necessary. At the same time it was so contrived that the workmen, while standing on the platform attached to the crane itself, could raise and lower themselves and it at pleasure. From the three sets of wheel and pinion, and of winches, *aa, ee, ii*, it will be seen at once that the crane has three powers; but the manner of its action will be better understood after we have noticed the several parts.

Fig. 1 is a side-view, and fig. 2 a horizontal plan. AB is the upright centre upon which the crane turns: it is formed of a cast-iron cylinder, ten inches in diameter. It is supported by the cross foot at A, the arms of which extend about three feet from the centre, and it has a series of holes for receiving the wedge, 2 (fig. 1), upon which the weight of the crane is supported. The pulley at B merely slips into the opening of the cylinder, and it can be removed at pleasure, so as to allow an additional cylinder to be added. The sides of the crane are formed of two very strong frames of cast iron, which are held together by bolts, two of which are made very strong (one of which is shown at 1, fig. 2), for receiving the upright.

DE is the weight-arm, formed of two cheeks, and strengthened by the wrought-iron stays, *kk*.

GH is the counterpoise-arm, formed of one strong piece of cast iron, and strengthened by the stays, *ll*.

W is the weight, and C the counterpoise, formed of a greater or smaller number of cast-iron discs, according to the weight.

PP is a platform for the workmen, suspended about three feet below the arbours of the winches. It is formed of planks, and is the only timber about the machine.

By working the winches, *aa*, the weight, W, is raised or lowered by the chain which passes over the truck-pulley, *f*, and is passed two turns round the barrel, *c*. In order that the power of the crane may be always the same, the chain is coiled, not upon this barrel, but upon the flanch-barrel, *d*, which is worked by the winches, *ee*, and may, in some cases, be used as an additional power.

A chain from the truck, *f*, passes over the pulley at E, and is hooked on the barrel, *h*, below; and another chain from the truck-roller, *g*, passes over the pulley at G, and is hooked on the same barrel below. Any link of these chains hooks on the barrel, so that when the crane is to be loaded, the counterpoise, C, and weight, W, may be placed in equilibrio. By working the winches, *ii*, so as to coil the chains upon the barrel, *h*, the trucks, *f* and *g*, and conequently the weights and counterpoise, are drawn towards the extremities of the arms, and by working the same winches in the opposite direction, they descend towards the centre by their own weight, preserving their equilibrium.

When the crane is to be raised or lowered, a chain is made fast to the arbour of the barrel, *c*, passing over the pulley, at B (as shown by the dotted line, fig. 1), to the barrel, *h*; then, by working the winches, *ii*, so as to shorten the chain, the crane is raised, and by working so as to lengthen the chain, the crane is lowered. The crane is turned round by pulling a gy-rope attached to the chain close by the weight W; and by the combination of motions, the crane is made to stand quite firm upon its cross foot, while the weight is brought with readiness and precision from any depth below, and to any point within the range of the arm, DE, traversing quite round.

BALANCE-CRANE, OR APPARATUS FOR LIFTING HEAVY GOODS.

We copy the following account of a most ingenious, though simple Apparatus for lifting heavy Goods from the Ground into Carts or Waggons, invented by Mr. J. W. Boswell (the celebrated improver of the Schemnitz engine for raising water), from No. 1 of the Repertory of Patent Inventions, a new and greatly improved series of the old Repertory of Arts and Manufactures.—Edit.

"It has often appeared to me, that society would be much benefitted by communications published relative to useful matters which may have occurred to individuals in their several pursuits or employments, and which, from various circumstances, they may not be able to render lucrative to themselves by the exclusive right of a patent, or other means, though valuable for their application to purposes of acknowledged utility.

"Influenced by this opinion, I have communicated several papers, which appeared to me to contain matters of this description, for publication at various times, and should have transmitted others, but have been prevented partly from the pressure of my business, and partly from considerations with which it is not material to trouble your readers.

"Some of these I have had the satisfaction to see adopted by gentlemen who had more opportunity to turn them to practical utility than I had. One gentleman, who made use of my improvements on the Schemnitz engine for raising water, has had the liberality to acknowledge his having taken his ideas from my paper relating to it in Nicholson's Philosophical Journal, in what he published respecting this matter; and another gentleman has done me the honour to take out a patent lately for my method of moving ships by compressed air, which was published in the Number of the Repertory of Arts for April, 1815, which, however, I presume, cannot be of much use to him, as, by this publication, I have not only established the priority of my claim to the invention, but, of course, have rendered his patent null and void.

"These two instances will, I hope, give some proof of what I have asserted relative to the value of such publications, and excuse me for again taking up some more of your pages with similar communications.

"Having had occasion, some time back, to send off several large cast-iron vessels, some of which weighed considerably more than a ton weight, and not being provided with a crane to lift them into a cart, I had to contrive some method for the purpose, less expensive, troublesome, and dangerous, than the united efforts of a number of men.

"I had some deal spars, a few planks, and some strong cord that had served for binding pearlash casks, but nothing else that could be at all applied to the use desired; with these, however, I made a shift to construct an extemporary apparatus, which I found extremely convenient for my design, very simple, easily put together, and of no cost, and which, as others may find it, or one of a similar kind, equally serviceable, I will describe at large.

"With three spars I erected what is commonly (though improperly) called a triangle, united together by cords at top, and diverging sufficiently at bottom to make it steady; to the top of this I fastened, by several rounds of rope, a strong beech plank by the middle, placing it edgeways (or with its plane vertical to that of the horizon), which plank was near 14 feet long, 10 inches broad, and about 2½ inches thick; to one end of this plank I fastened a large scale, used for weighing, and secured it well by triple cords at each angle. I then brought down the other end of the plank sufficiently low to raise the scale above the level of the cart, and in this position had it bound firmly by several rounds of cord to the vessel which I desired to raise: I then had the scale loaded with heavy matters (weights, pieces of iron, and bricks), till it balanced the vessel, after which it was easily raised and placed in the cart, by backing the horse till it came under it in the proper position; and then, by taking the weights out of the scale again, the apparatus was as readily disengaged.

"I found this simple apparatus so convenient for loading carts, that I used it several times afterwards for lifting casks of Epsom salts, and other matters, under 200 cwt.; which leads me to suppose, that one on the same principle would be found very useful for raising any weight greater than what one man could lift with facility, and that it would be advantageous to have one erected permanently for the use of any business where heavy weights are required to be raised from the ground into carts or waggons.

"When an apparatus of this kind is wanted for permanent use, I would recommend the following alterations to be made in its construction. Instead of three spras placed as before described, a single post might be fixed erect, about 10 feet high, and be well secured from inclining from the perpendicular position by the usual means; in the top of this post a hole should be bored vertically, 1½ foot deep at least, and be secured by an iron cap well fastened, having an aperture directly over the hole; the use of this hole is to receive the shank of a piece of strong iron, forked above to receive the centre of a balance beam, and having holes in the forked parts for a gudgeon to be passed through them and the beam; a scale should be fastened well by chains to one end of the beam, so as to be about four feet from the ground when the load is fastened to the other end of the beam, or a little higher than the bottom of a common cart, and the other end of the beam should be furnished with a short chain and hook, for taking up any packages or other matters which were required to be raised into carts. A number of half-hundred weights should be also provided, equal collectively to the weight of any package usually sent off the premises. The square half-hundreds, which are made with a handle sunk in the body of the weight, would be most handy for this purpose, as they could be readily piled one on another in the scale, when required, without any danger of falling off. Weights of other sizes might doubtlessly be used for the same purpose; but it seems to me, half-hundred weights could be raised quicker into the scale than larger or smaller sizes, for a given load, by men of ordinary strength. It will be obvious, that the use of the forked support for the balance beam having a shank descending into the body of the post, is to admit of the beam being turned horizontally, for the greater convenience of putting goods into carts, while they remained in a fixed position; for which reason the shank should be well rounded above, and fit properly in the cap, and should also have a socket let down into the body of the post to sustain its lower extremity, to admit of its being turned round with more facility.

"As this apparatus serves most of the purposes of a crane, if it should ever come so far into use as to require a name, I would propose to call it the *Balance-Crane*.

"All the cranes hitherto used have a defect, from which this, which I propose here, would be free, which is, they require very near as much time to raise a small weight as a large one; for though the winch, or other operating part, which puts the machinery of the crane into motion, may be turned round somewhat quicker for the small weight, yet, as it must be turned round an equal number of times in both cases, the different degree of speed which a labourer *will* use with a smaller weight will not be found of much benefit; whereas, with the balance crane, the time and the labour must be exactly proportionate to the load to be lifted; ten hundred weight only requiring half the number of weights to be lifted which would be necessary for a ton, and a smaller load proportionally less.

"I have seen some cranes where this defect was attempted to be obviated, by having two or three toothed wheels of different sizes on one axle in the machinery of the crane, so fixed, that the pinion turned by the winch or handle of the crane might be transferred from the wheel of the larger diameter to that of the smaller size, when required for a smaller load; but it is obvious that this contrivance could have but a very narrow limit, and could only vary according to the number of wheels placed for that purpose, the addition of which proportionally increased the expense of the crane, and its complication, while the principle of the balance crane enables it to vary its power, and the time of the operation, exactly in proportion to the load, without any complication of parts, or additional expense of construction.

"I have a plan for another crane on similar principles, which I think considerably superior to those described here, when intended for constant use; and which, when wanted for raising great loads frequently, would cost but little more than the last; but to make this known as it should be, I must wait for some better opportunity."

ON THE USE OF THE SLIDING RULE.

(*Concluded from page 228.*)

PROBLEM XI.

To find the number of *ale* gallons contained in a cask, from having the length and mean diameter given.

RULE.

Set the length on C to the gauge

point (marked AG) on D, then against the mean diameter on D is the content on C in *ale gallons.*

EXAMPLE I.

What is the content, in ale gallons, of a cask whose mean diameter is 28 inches, and length 36 inches?

Set 36 on C to AG (the guage-point) on D, then against 28 on D is 78 on C, nearly the content in *ale* gallons.

NOTE.

The guage-point is that number on the rule shown at AG (the point at 18·95), which is found by dividing the cubic inches in an ale gallon, viz. 282 by ·7854, the area of a circle whose diameter is 1 or unit, and extracting the square root, thus:

$$\sqrt{\frac{282}{\cdot 7844}} = 18\cdot 95.$$

PROBLEM XII.

To find the number of *wine* gallons, having the length of the cask and the mean diameter given.

RULE.

Set the length on C to the guage-point (marked WG) on D, then against the mean diameter on D is the content in *wine* gallons on C.

EXAMPLE I.

What is the content, in wine gallons, of a cask whose mean diameter is 28 inches, and length 36 inches?

Set 36 on C to WG (the guage-point) on D, then against 28 on D is 98 on C nearly.

NOTE 1.

The guage-point is found on the rule by dividing 231, the number of cubic inches in a wine gallon, by ·7854, and extracting the square root, that is, $\sqrt{\frac{231}{\cdot 7854}} = 17\cdot 15$, the point marked WG on the rule.

NOTE 2.

The mean diameter, for most purposes in actual practice, is found by adding the head diameter to the bung diameter; the former measured from outside to outside the cask, and the latter by inserting a rule in the bung-hole, and reckoning to the point where the outside also of the cask meets it; then take half their sum, to which add its twentieth part for the mean diameter, and this rule is founded on actual experiment on several casks of different forms and dimensions, and compared with actually filling the casks afterwards, and not from any theory which supposes the casks to be of regular and determined figures, which is never the case, as the inside is left by the workmen very irregular, as well as the form itself depends, in a great measure, on the fancy of the workman.

I shall here conclude the description of the common carpenter's sliding rule, as what has been shown will, I trust, enable the workman to perform any operation he may have have occasion for, as well as thoroughly to understand its construction. I shall, however, at some future time, extend this article by a description of some other *Rules*, and particularly one called the *Improved Sliding Rule*, which, though not in general use, is deserving the consideration of the practical mechanic, and which, by the assistance of an extra slide, is applicable to almost every purpose of mensuration or arithmetical calculation.

I am, Sir, yours truly,
G. A. S.

An Inquiry into the Strength of Man to move Burdens, either by lifting, carrying, or drawing, considered absolutely, and with comparison to that of Animals which carry or draw. By M. DE LA HIRE. *(Translated from the Memoirs of the Royal Academy of Sciences at Paris, Nov.* 10, 1699.)

I suppose, in the first place, that a strong man, of a middling stature, weighs 140lbs. of our weight. I consider, first, that such a man, having his knees on the ground, can raise himself by resting only on the point of the feet, and the two knees being continually joined together; and as this effort is made by means of the muscles of the legs and thighs, it is evident, by the supposition just made of his weight, that the muscles

of the legs and thighs will have strength to raise 140lbs. But a man having the hams a little bent, can recover himself, though loaded with a weight of 150lbs., together with the weight of his body, which he raises at the same time; so that the force of the muscles of the legs and thighs can raise a weight of 290lbs.; that is, 150lbs. of the weight with which it is loaded, and 140lbs. of the weight of his body, when the elevation is but two or three inches. Such a man, as we have already supposed and considered, can also raise from the earth a weight of 100lbs., which shall be placed between his legs, by only bending the body, and taking this weight with the hands as with two hooks, and then recovering himself; whence it follows, that the muscles of the loins alone have strength to raise a weight of 170lbs.; that is, 100lbs. of the weight, and 70lbs., which is half his own weight; for he must not only raise the weight of 100lbs., but all the upper part of his body, which I estimate at 70lbs., seeing he bent down to lift the weight. As for the force of the arms in drawing or raising a burden, it may be reckoned at 160lbs., which depends on the force of the muscle of the shoulders and arms. For if a man take, with both his hands, any fixed body placed above his head, he can easily, by the sole effort of his arms, raise his whole body, and 20lbs. besides, as if he were loaded with the weight of 20lbs. The experiment of this may be easily made; let there be a weight of 160lbs. fastened to the extremity of a cord, which passes over a pulley, and let a man who weighs but 140lbs. draw the other extremity of the cord; it is evident that he can never raise the weight of 160lbs., seeing all that he can do is to hang upon the cord, and the weight at the other extremity weighing more than he, will keep him suspended, for the pulley is nothing but a continued balance with equal arms; but if this man be loaded with a weight of 20lbs., then he will make an equilibrium with the weight on the other side; and if we add to this 20lbs., then he will raise the weight, for the muscles of his shoulders and arms have strength enough to raise all the weight.

Although the muscles of each part of the body are able to make such great efforts to raise burdens, and though the spirits which swell the muscles serve to motion in general, by contracting themselves and drawing the tendons of their extremities, and may distribute themselves equally into all those parts, in the same manner with a separated part, yet we must not compute the strength of a man by that of all his muscles together, seeing each part usually serves for a support to that to which it is joined. For example, the muscles of the arms and shoulders, contracting themselves, can raise a weight of 160lbs.; but if the body be bent, the arms cannot sustain this weight, unless the muscles of the loins have strength, at the same time, to sustain the upper part of the body with the weight with which it is loaded; but if the hams were also bent, then the muscles of the legs and thighs must still make a greater effort, as they must sustain the weight of 160lbs., and at the same time that of the whole body. Whence it happens, that in this disposition of the whole body, the strength is divided by the distribution of the spirits into all the parts, which is the cause that a man cannot raise from the ground a weight of 160lbs. Not but there may be some men whose spirits flow in such abundance, and with so much rapidity, into their muscles, that they make efforts triple and quadruple of what is usual; and this appears to me the natural reason of the surprising force that we see in some men who carry and lift such burdens as two or three men together would be at a loss to support, though these men are sometimes of a moderate size, and seem outwardly rather weak than strong. There was one not long ago in this country, who was said to carry a great smith's anvil, and of whom several wonderful actions were related; but I saw another at Venice, who was young, and did not seem to be able to carry above 40lbs. or 50lbs., who, getting upon a little table, raised an ass from

the ground, and held it up in the air, by a large girt that went round the belly, and was fastened at each end to hooks, which hung at the end of two little bands made of small cords, and a few hairs on each side of the head of this young fellow; and all his strength depended on the muscles of the shoulders and loins, for he stooped at first, whilst the hooks were fastened to the girt, and afterwards he lifted the animal off the ground, leaning his hands upon his knees. He again raised, in the same manner, other burdens, which seemed heavier than this animal, and said he found less difficulty in it, because the ass struggled when it was off the ground.

I now examine the effort of a man to carry a burden on his shoulders: I say, the weight of this burden may be 150lbs., and that he can walk with this load easily enough on a horizontal plane, provided he does not make great strides; but he cannot go up a hill or a ladder with the same weight, for the action of walking with a burden on the shoulders, must be considered as the circular motion of the centre of gravity of the body, and of the weight joined together on the foot which advances, as the centre of the arch of motion, the effort of the muscles of the other leg serving only to push the centre forwards; and if the arch described by this centre is small, the effort of the hinder leg must not be great to make it be described, seeing the whole burden of the body, and of the weight, is not to be raised by more than the versed sine of half the arch, which is not considerable in this case, with regard to the arch which is the path in which the whole burden advances. Thus we see, that a man well loaded can walk the more easily, as he makes less strides, seeing the sine will be so much the less, and that he could not advance by making large strides; that the effort of the hinder leg could not raise the burden of the body and of the weight, by the quantity of the versed sine of the arch, which would be half the step. It is easy also to see, that the same man cannot go up a ladder, or steep hill, with this load; seeing, according to what we have before explained, the effort of the muscles of his legs being able to raise a weight of 150lbs. only to the height of two or three inches, he could not raise it to five inches, which is the height of the usual steps; nor go up a hill, without making such short steps as to rise but two or three inches at each. It therefore now remains for me only to consider the effort of a man to draw or push horizontally. To render this explication more clear and intelligible, I consider his strength applied to the handle of a roller, the axis of which is horizontal, and over which a cord is turned which sustains a weight; having supposed the distance from the centre of the roller to the elbow of the handle equal to the semidiameter of the roller, that the force may be compared, being applied, without any augmentation, on the side of the machine; I have also had no regard to the friction of the axis of the roller, nor to the difficulty which the cord may have to bend.

First, it is evident, that if the elbow of the handle is placed horizontally, and that is about the height of the knees, the effort of the man who raises it in drawing may, at the same time, lift the weight of 150lbs. which shall be fastened to the extremity of the cord, taking all possible advantages, seeing it is the same as to raise the weight, as I have already explained. But if it is to depress the handle, his effort can be no more than 140lbs., which is the weight of his whole body, that he can apply by bearing upon it, unless he is loaded, for then he could make a much greater effort.

Secondly, if the elbow of the handle is placed vertically, and is at the height of the shoulders, it is certain that a man can make no effort to turn it, by drawing it or pushing it with his hands, if the two feet are against each other, and the body straight, which is represented by the line AP, fig. 1; and if the line of the arms, represented by AM, is horizontal, and makes a right angle with AP; since, in this position, neither the force of the whole body, or of its parts, nor its weight, can make any

effort to push or draw, which is known by mechanics; for I consider the breadth of the feet only as a single point, P. But if the handle is higher or lower than the height of the shoulders, then the line which goes from the shoulders to the hands, which is AM, and that which goes from the shoulders to the end of the feet, which here is AP, will make an obtuse or an acute angle, and the man may have some force to draw or push the handle, and this force depends wholly on the weight of the body, as is easy to know and demonstrate; and this weight, or this force, must be considered as reunited in his centre of gravity, which is near the navel, within the body; I say, that regard must be had only to the weight of the body to determine the equilibrium, for the effort of the muscles of the leg and thighs serves only to preserve this equilibrium in walking.

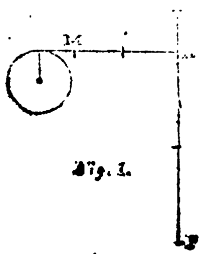


Fig. 1.

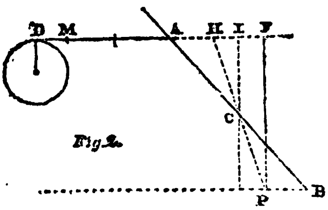


Fig. 2.

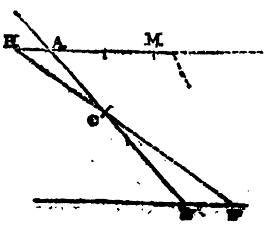


Fig 2. Let the handle, D, be at the height of the shoulders, A, and let the centre of gravity of the body be at C, the body being much inclined towards the handle, but let the end of the feet be at P. We must consider, first, this point, P, as the fulcrum of a lever, or straight rod, PCH, which passing through the centre of gravity, C, of the whole body, meets the line of the arms, MA, at the point, H; secondly, that this point, C, of the lever being loaded with the weight of all the body, 140lbs., with its natural direction, its extremity, H, is sustained with the horizontal direction, MAH; whence it is easy to conclude, by mechanics, what effort the weight of the body at C, with its natural direction, can make on the handle, according to the horizontal direction, DH. For, first, let PH be of 240 parts, and PC of 80; since the effort of all the body at the point, C, is 140lbs., it will be but 80lbs at the point H; as if, at the point H, there were a weight of 80lbs. suspended with its natural direction, which must be, on the supposition that we have made, perpendicular to MA. Wherefore, if we draw from the point of support, P, the line PF, perpendicular to MAF, the weight of 80lbs. at H, with its natural direction, will be to the effort of the same according to the horizontal direction, MAH, on the handle, in the ratio of PF to HF, which very much diminishes the effort of the 80lbs. in a moderate inclination of the body, ACB. And if we suppose, for instance, that the line PCH makes with MAF the angle PHF, of 70 degrees, the line of the body, ACB, will then be inclined to the horizon, or with MF, an angle of more than 60 degrees, which is at most the inclination in which the body can be able to walk; and the sine of 70 degrees, which is PF, will be to the sine of its complement, which is HF, very nearly as three to one; and, consequently, the effort of the 80lbs. at H, according to the natural direction, will be to that which they make according to the horizontal direction, only one-third of 80lbs., which is little less than 27lbs.

Those who have not made the experiment of the strength of a man, to push horizontally with the arms, or to draw a horizontal cord in walking, the body being inclined forwards, whether the cord be fastened towards the shoulders or about the middle of the body (for the effort will be no greater in the same inclination of the body, since the sines of inclination and their complements are always in the same ratio), cannot persuade themselves that the whole strength of a man is reduced to draw only 27lbs. with a horizontal direction. Not but a man, being bent, can sustain a much greater weight than 27lbs., seeing, if the line PH made with HF an angle of 45 degrees, it is certain that the weight of the body would sustain 70lbs.; but as he would be bent according to a line, as AB, which would be much more inclined to the horizon than 45 degrees, it is certain that, far from being able to walk, he would hardly be able to sustain it.

The same demonstration serves also to show, that a man will have much more strength to draw in walking backwards than forwards; for, in this situation of the body, the line PCH, fig. 3, which passes from the end of the feet, P, through the centre of gravity, C, and whereon depends the augmentation of the force, will be always more inclined to the horizon than the line of the body, ACB, quite contrary to what it is in the preceding position. But this manner of drawing could not be put in practice, unless it was only to draw a cord, the man continuing always in the same plane; and one should not fail of putting one's self in this posture in such a case, for nature and experience have taught us to take always all possible advantage in common operations. It is for the same reason, also, that our mariners, and, in general, all who row on the sea, always pull their oars from before backwards, for they have much more force than if they pushed them forwards, as the gondoliers of Venice do, for which I see no other reason than that of seeing before them; which is much more necessary for them than great force, because of the frequent turns they are obliged to make in the canals, and to avoid running against each other.

It remains for me, in the last place, to compare the strength of men with that of horses in drawing, which are the strongest of all drawing animals; but as it does not entirely depend upon their weight, as that of a man does, but principally on the muscles of their body, and on the general disposition of its parts, which have a very great advantage in pushing forwards, we must be content with the common experiment, that a horse draws, horizontally, as much as seven men; and thus a horse can draw horizontally only a little less than 200lbs. Not but that, when loaded, he can draw a little more; but it is but little in proportion to our idea of the great strength of this animal. But as it is usually considered as being applied to some wheel-carriage, such as carts, we cannot make a just estimation of it, because, on a smooth and horizontal plain, they need no more force than is necessary to overcome the friction of the axle-trees. We may observe again, that three men will do more than a horse in carrying a burden up a steep hill for three men, loaded with 100lbs. each, will rise more easily and quickly than a horse loaded with 300lbs., which comes from the disposition of the parts of the human body, which are better adapted to ascend than those of a horse.

NEW HARROW.

Mr. Finlayson, of East Lothian, has obtained a patent for a New Harrow, called 'Self-cleaning,' which is an important improvement in the cultivation of land. Its chief merits are, that it requires less labour than the common harrow, that it destroys the weeds deeper, that it throws them on the surface without becoming choked, that it pulverizes the earth more effectually, and that it can, in a moment, be regulated to work at any necessary depth.

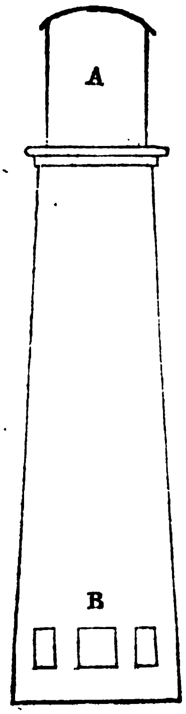
ON THE IMPROVEMENT OF LIGHT-HOUSES;

BY SIR JOSEPH SENHOUSE.

Sir,—Although great improvements have, of late years, been made throughout the British dominions upon Light-Houses, yet I think it is possible to make farther progress in so useful and necessary a building.

In the first place, I would propose that every light-house should have a different colour, as red, yellow, blue, &c., by which means they would be immediately identified at night, as soon as perceived, which cannot so certainly be done if they are all alike in that respect.

In the next place, I would recommend that they should be so constructed as not only to ascertain the situation of headlands, harbours, &c., but also to determine the *distance* the observer may be from them, in the following manner, viz.—



Suppose the light-house to be erected according to the above elevation, and of a conical form, the great light at A may have what tinge may be thought proper; underneath, at B, being 100, 150, or 200 feet distant, I would recommend three or more smaller lights, to be seen a few leagues at sea. So long as these last-mentioned are *not* seen, the observer may conclude he is a considerable distance from it; but, as soon as any one of them is perceivable, he need only take the angle of altitude between it and the great one, and in a table calculated on purpose beforehand, he will find the distance he is from the light-house by an easy and expeditious method, sufficiently exact for his purpose.

I am, Sir,
Your well-wisher,
Jo. Senhouse.

Heusingham Hall, near Whitehaven,
June 8th, 1825.

REAPING CORN.

The French claim the merit of a new discovery of great importance to agriculture in the advantages which, according to them, result from the practice of reaping corn before it is perfectly ripe. This theory, which has just been promulgated by M. Cadet de Vaux, originates with M. de Salles, of the Agricultural Society of Beziers. The following are the particulars:—Corn reaped eight days before the usual time is, in the first place, secured from the dangers which threaten it at that time—this is only accidental; but a positive advantage is, that the grain is fuller, larger, finer, and that it is never attacked by the weevil.

The truth of these statements has been proved by the most conclusive comparative experiments upon a piece of corn, one-half of which was reaped before the usual time, and the other half at the degree of maturity fixed by the ordinary practice. The first portion gave a hectolitre of corn more for half a hectar of land. Afterwards, an equal quantity of flour from the wheat of each portion was made into bread; that of the corn reaped green gave seven pounds of bread more than the other in six decalitres. Lastly, the weevil attacked the corn which was cut ripe, the other was exempt from it. The

proper time for reaping is that when the grain, on being pressed between the fingers, has a doughy appearance like the crumb of bread just hot from the oven, when pressed in the same manner.

DAMP-DETECTOR.

An ingenious little instrument under this name, which denotes its use, has been invented by Mr. Essex. It consists of a small ivory box, about an inch in diameter, in which is a needle turning on a pivot, like the small pocket compasses. Being set to zero, it either proceeds or recedes as the surrounding atmosphere is moist or dry. Thus the state of the atmosphere may be ascertained by invalids; but, perhaps, the greatest utility of the instrument can be experienced by travellers, since, by placing it for a few minutes only between bed-clothes or wearing-apparel, the motion of the index certainly detects the existence of damp, if there be any present.

LONDON MECHANICS' INSTITUTION.

SIR,—Allow me to request that you will correct an error which appears in your Magazine of the 16th inst. Speaking of the new Theatre of the London Mechanics' Institution, you say (page 232), "The construction of the building does great credit to its designer, Mr. M'William, one of the Vice-Presidents of the Institution." Now it happens, that though I have the honour to be one of the Vice-Presidents, yet this Theatre has been constructed under the direction of the whole Committee of Management, consisting of thirty-six persons, each of whom has an equal claim to such merit as the construction of the Theatre in question may deserve.

RT. M'WILLIAM.

Furnival's Inn, July 26th, 1825.

IMPROVED AMERICAN STEAM-BOAT.

SIR,—As I was looking over an American newspaper a short time since, I was much pleased with the following description of a new Steam-Boat, recently built at or near New York; and believing that you are ever willing to communicate any thing that may tend to excite a progressive improvement in the machinery of this country, I have taken the liberty of forwarding it, in the hope that the hint may prove serviceable to some of your readers who may be more *practically* interested in the subject than myself. There have been several objections raised (and perhaps justly so) against steam-boats, as they are generally constructed; and if by the adoption of this or any other plan, these objections can be obviated, I apprehend it will be no little benefit both to the proprietors and the community at large. Without intruding further in your interesting pages, I shall subscribe myself,

Yours, &c. W. C. H.

Kelvedon.

From the Philadelphia Freeman's Journal of April 20.

THE TRENTON STEAM-BOAT.—The Trenton is constructed upon an entire new model. Her boilers rest upon the guards projecting over the water from each side of the boat. This leaves the deck entirely unobstructed, and forms what may be called a promenade deck. The space usually occupied by the boilers is converted into convenient and elegant dressing-rooms. Should any accident happen to the boilers, the water would be thrown directly into the river, and not in the least endanger the passengers. And what is likewise important, the unpleasant and annoying degree of heat in the dining cabins is no longer felt. She was built at Hoboken, and it may be fearlessly asserted, the improvements in the arrangement and disposition of her machinery are far greater than any that have been yet made since the first introduction of these boats into our waters. She might not unaptly be called the *Water Travelling Balloon.*

MR. BADNALL'S PATENT THROWING MACHINE.

SIR,—I observe in your Number of the 2d inst. some observations by

"A Weaver," as he signs himself, in Wood-street, relative to my patent Throwing Machinery; and although I should feel a much greater satisfaction in replying to such kind of queries, were they authenticated by the proper signature of the writer, yet, as it will not occupy much time in answering them, I will endeavour to set your Correspondent at rest in as few words as possible.

It is perfectly evident, from his own statement, that he is not very intimately acquainted with either silk, wool, or cotton machinery, otherwise he would know that from one to three thousand revolutions of the spinning spindle per minute are but a common speed; and that in certain manufactories in different parts of England, *that* speed is increased to from four to six thousand revolutions; and I believe there are instances in cotton-spinning where the number of revolutions per minute considerably exceed even that.

The allusion your Correspondent makes to my reply to a letter which some time ago appeared in your Magazine, I shall pass over by merely remarking, that I am not in the habit of making statements which I cannot thoroughly substantiate; and that whatever may be the opinion of either him or his friends as to the impracticability of such statements, I should in future strongly recommend their being perfectly certain of *such impracticability* before they ventured to publish any decided sentiments on the subject.

As to the remark of your Correspondent, that the general opinion of the silk trade is adverse to my patent, time alone can determine how far it is so: on this point I am perfectly easy.

The Weaver in Wood-street is likewise very much out of his mark when he supposes that my spindles are driven by toothed wheels; and the publication he has given to this error convinces me that he is as perfectly ignorant of the nature of my Throwing Machinery, as he is of any other, unless it be the wooden crawling mass of cumbrous matter which his friends have described to him; which, even through France and Italy, has for years been gradually improved upon, and a most fascinating model of which has been exhibited, for Heaven knows how long, in the Tower of London.

There is, however, one puzzling query still remaining unanswered, which I conceive your Correspondent intended as a *regular poser*. "*How do I calculate the velocity of my spindles?*" I must confess, that not feeling myself quite competent to answer this question, I most unwillingly throw myself on the mercy of your numerous readers, sincerely hoping that some one will be kind enough to gratify your Correspondent by a solution of this important question, and at the same time assist me in so extraordinary a dilemma.

I have the honour to be, Sir,
Very faithfully yours,
RICHARD BADNALL, JUN.

P.S. Your Correspondent may probably be more inclined than ever to doubt the accuracy of my assertions, when I assure him that I can show him the bobbins upon silk-winding engines revolving at a *greater speed* than the limit he assigns to that of Throwing Machinery.

REPLY TO A LETTER ADDRESSED TO W. E. WIGHTMAN, ON GUNNERY.

SIR,—In your valuable Magazine, p. 132, vol. IV. I find a letter addressed to me, signed "O.;" and as it appears that I have not been sufficiently intelligible, I will endeavour to answer such parts of "O.'s" letter as are answerable; there are some which seem to me to require no answer. Three kinds of barrels are in general use amongst sportsmen; viz. the Damascus, wire-twisted, and Stubbs-twisted. The Damascus barrels are the least expansive when fired, and the wire-twisted the most. This may be known by placing lead hoops on the barrel that is to be fired; the lead not being elastic, does not contract with the barrel after firing, but plainly shows how much the barrel expands under the trial. This is *how* I "discover the *difference*."

The Damascus barrels having little

or no expansibility when fired, do, in consequence, require to be bored perfectly cylindrical. The charge, when propelled from such barrels, meeting with no irregular resistance or strait places, occasions but little recoil, while the Stubbs-twisted, on account of their flexibility, require to be bored wider at the breech, that the shot may be partially delayed, by being driven into the straiter part of the barrel, that it may receive the full strength of the powder. The intention of boring guns in this manner is to counterbalance the expansion during the discharge; for, as I previously observed,* the shot could not be dislodged with equal force when the barrel yields to the expansion of the exploded powder. The consequence of boring guns in this manner cannot but be understood by the most uncircumspect observer; for the necessary dilatation of the barrel during the passage of the charge through the straiter part, distends the fibres of the metal to a degree which their elasticity cannot always recover; and hence follow the repeated burstings of guns by a small addition to the regular charge.

The Table on the Cohesion and Strength of Metals, vol. I. p. 71, of your Magazine, would have saved "O." (had he seen it) such futile expressions as those regarding welded needles, hoop-iron, cast iron, and brass: and with respect to a succeeding remark of his on the strength of barrels, where he says, "*I do not see why a barrel should shoot the better for being thick; that is, a barrel as thin as writing-paper should shoot as well as a barrel half an inch thick, provided the force of the powder do not make any* permanent *alteration in the size of the bore.*" Let me ask him, if any barrel were subject to this *permanent* alteration every time the gun was fired, how many shots he must have before a 5-8ths bored fowling-piece would swell to a two-inch duck-gun?

How is it possible to lay down any specific rule for the boring of gun-barrels, when, by reference to the above-named tables, there is so great a difference in the cohesion of iron, of which gun-barrels might be made? All that I can say on this point is, that a scientific man will easily find the proper bore for every barrel by the assistance of lead-hoops. The process is troublesome, but certain; it is done thus: Place one hoop on the muzzle of the barrel, one about half-way down, and one a few inches from the breech; then place the barrel in a horizontal direction, and fire it with touch-paper; and if the barrel regularly narrows from the bottom to the top, and is *correctly* bored, the hoops will be found to have increased equally in size with their first proportions. This is the best, nay, the only criterion, by which a barrel is to be known when properly bored *for shooting*. The next consideration is the length, which can only be regulated by trial. The nearest rule for the length, &c. of gun-barrels is as follows: the length should be 50 diameters of the bore, and the thickness at the breech for a half-inch bore should be 1-8th inch, and should increase 1-16th inch in strength with every 1-8th inch increase in the bore. The best method that I find to prove whether a barrel is perfectly cylindrical in the bore, is by a lead plug, about one inch long, and merely turned to fit the barrel. By gently forcing it through, it will show any irregularity in the inside.

The uncertainty of the *regular* shooting of guns, as will be seen by a schedule of Telloc Trigger's, precludes the possibility of an answer to the last question.

I am, Sir, yours, &c.
W. E. WIGHTMAN.

Malton.

* Page 95, vol. IV.

REPLY TO HAMMER.
Page 132, Vol. IV.

SIR,—IN reply to "Hammer," I must say that the best method of removing the *lead* from gun-barrels, is to subject it to the boring bench of a good workman; for he can so *pack* the boring bit as to bore out the lead without touching the iron; but when that cannot be done, a fine steel wire

brush, which most gun-makers send either with the ramrod or washrod, will answer the purpose tolerably well. By using it constantly, the gun will be prevented leading at all. But it must be observed, that, previous to the use of the brush, the touchhole should be closed, and the barrel filled with boiling water, which softens the adhesive powder, and partially assists in cementing the lead to the barrel. The barrel should afterwards be washed in *cold* water, for the steam from *hot* enters the pores of the iron, and will not, from its confined situation, evaporate for some time.

"Hammer" will find a proof of the comparative merits of the Flint and Percussion Guns in the same page with his communication.

I am, &c. &c.

W. E. WIGTHMAN.

Malton, July 4, 1825.

PERPETUAL MOTION ON PHILOSOPHICAL PRINCIPLES.

SIR,—The following is copied from a foreign work: should you consider it worthy publication, it is much at your service.

R. W. DICKINSON.

Albany Road.

"The power is at present applied to the machinery of a clock; this clock, unconnected with the power, is calculated to go for two years without winding up, by the weight of a single pound, that gives motion to a pendulum of twenty pounds, which moves through a space of 518·400 inches in 24 hours, while the small maintaining weight (a single pound) descends only 1-10th of an inch. The internal work of the clock consists of three wheels. In order that the superiority of this movement may be obvious to every understanding, as well as to those more conversant with the more difficult parts of mechanics, it is necessary to mention, that the common eight-day clock requires a weight of fourteen pounds, where this only requirs a weight of one, is wound up once in eight days, and moves a pendulum of three pounds and a half, when this moves one of twenty, and is wound up only once in two years. In twenty-four hours the maintaining weight of the common clock descends six inches; in this it descends only 1-10th of an inch. The least weight which we at present recollect to have heard of being used by the first artist of London is five or six pounds, where this requires only one, in consequence of the diminution of friction. So far it has been thought necessary to describe this clock in comparison with the common one.

"We now come to that part to which extraordinary merit is to be ascribed —the faculty of winding itself up without the intervention of human power. This faculty is derived from the weight of the atmosphere, and can never cease (under the conditions after mentioned) while the machine lasts, and while a column of air either loses or gains 1-150th part of its common weight five times in the space of two years, the time which the clock goes without requiring any assistance; or, in other words, as long as the change of the weight of the air, five times in the space of two years, shall be such as to cause the mercury either to ascend or fall 2-10ths of an inch in the barometer above or below its mean height. The wearing out of wheels, or of any kind of machinery by friction, never can be avoided; accordingly, it has never been required in the discovery of a perpetual motion. It is therefore sufficient, on that subject, to say, that the present machine, upon a fair comparison of its friction with that of the common clock, would probably move *five centuries*, a period sufficient for any purpose that can be required."

THE MARINE CRAVAT AND SCHEFFER'S LIFE-PRESERVER.

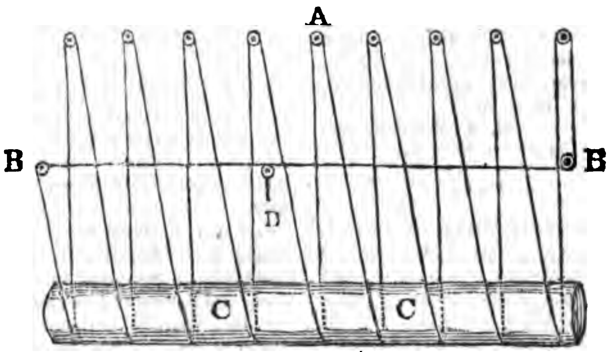
SIR,—It is not my intention to enter into any discussion with mechanics as to the respective merits of the "Marine Cravat" and the "Life-Preserver," as it is evident they are only different methods of applying the same principles.

I am certainly of opinion, that Mr. Scheffer's plan of inflating his machine with air instead of employing cork, is decidedly superior, not only on account of the greater buoyancy obtained, but from its being thereby rendered more portable, as it can, when wanted, be inflated for use in the twinkling of an eye. For the information of mechanics, I will, with your permission, describe a simple method of constructing a "Marine Cravat," not only much cheaper, but equally efficacious with that of Mr. J. H. Bell. Procure at any butcher's a bullock's *weasand* for 4*d*., which inflate with air; then with a piece of sail-twine divide it into four or five compartments, like a string of sausages, to enable it to take a circular form; tie this round your neck, and you will be able to keep yourself at the surface of the water with the slightest exertion, as I can vouch from experience. But a better and genteeler application of this contrivance is to provide yourself with *two* such annular floats as I have just described, into which introduce your arms up to the shoulders, and connect them together by a string behind. With the assistance of these "Marine Epaulets" mechanics might, with the famous Benjamin Franklin, take a nap upon the water in the most perfect security.

I am, Sir,
Your well-wisher,
T. BELL.

2, Commercial-row, Whitechapel.
July 19, 1825.

METHOD OF BANDING SPINDLES UPON AN OLD, BUT ALMOST FORGOTTEN PRINCIPLE.



Place a pulley at one end of the frame betwixt the roller and the spindles, then pass the band through the pulley and round the spindle, from whence it must be passed on to the roller, and from thence to the spindle, and so on in succession until it comes to the other end of the frame, where another pulley must be fixed, and through which the band must be passed and carried betwixt the roller and the spindles to the first pulley, where the ends of the band are to be joined together.

N. B.—Although, by this method, *any number* of spindles may be banded together, it would, perhaps, be advisable not to exceed twenty.

Description.

A, the spindles.

BB, the pulleys, fixed at each end of the frame.

CC, the roller.

D, a pulley to support the band, the band going under the roller.

SAMUEL SMITH.

Smedley, near Manchester,
July, 1825.

FIRE-ENGINE.

A new Fire-engine has been invented at Berne, by a mechanic named Schenk, which possesses much greater facility than any former machine of the same description. Its force is said to be so extraordinary, that the column of water which it sends out will, at the distance of 100 feet, easily break up the pavement of the street, untile the houses, and demolish their masonry up to the second floor.

MACHINE FOR UPROOTING TREES.

A Toronto farmer says, in a letter to an American Paper, that he had "just seen a Machine for pulling up the Stumps of Trees, invented by a Mr. Harris, an ingenious mechanic, which is extremely powerful, multiplying the force applied to it 700 or 800 times, which also can be increased or diminished as occasion may require. It is capable of pulling out the largest stumps, and can be moved from place to place by a single yoke of oxen: it is, withal, very simple, and may be worked by either men or horses. The machine will, when delivered and erected, cost about 25 dollars."

TO PREVENT MISCHIEF BY ROOKS.

Take a straw-rope, such as is used in some counties for thatching, and stretch it across the field from about the middle towards the fences, supported by stakes fixed in the ground, to raise it a few feet. This is a sufficient notice to the rooks to keep off. If fields are large, other ropes may be placed at a proper distance; for if food grows scarce, they may, after cautiously reconnoitering for some time, approach to within 200 or 300 yards of the supposed trap.

NEW PATENTS.

Augustin Louis Hunout, of Brewer-street, Golden-square, gentleman; for certain improvements in artillery, musquetry, and other fire-arms. Communicated to him by a certain foreigner residing abroad.—Dated April 23, 1825.

Thomas Alexander Roberts, of Monford-place, Kennington-green, gentleman; for a method of preserving potatoes and certain other vegetables.—Dated April 23, 1825.

Samuel Ryder, of No. 40, Gower-place, Euston-square, coachmaker; for an improvement in carriages, by affixing the pole to the carriage by a new-invented apparatus.—Dated April 28, 1825.

Daniel Dunn, of King's-row, Pentonville, manufacturer of essence of coffee and spices; for an improved apparatus for the purpose of beneficially separating the infusion of tea or coffee from its grounds or dregs. — Dated April 30, 1825.

James Fox, of Plymouth, rectifying distiller; for an improved safe to be used in the distillation of ardent spirits. —Dated May 14, 1825.

TO CORRESPONDENTS.

If J. B. C. D. has really made the discovery he speaks of, there is no doubt he may obtain both profit and honour by it. We would recommend him to apply to the Commissioners of Weights and Measures.

Anti-Hippopotamus would be much obliged to Mr. Thomas H. Bell, if he would inform him how to mount his Water-horse without capsizing it?

Communications received from—Felix —D. D. E.—Plane—J. Walker—Taper—P. Smith—Dick Forge—Samuel Smith—Ikey Pringle—Timotheus—R. W.—D.—A. R. F.—A Reader in the Potteries—A Seaman.

**** Advertisements for the Covers of our Monthly Parts must be sent in to our Publishers before the 20th day of each Month.*

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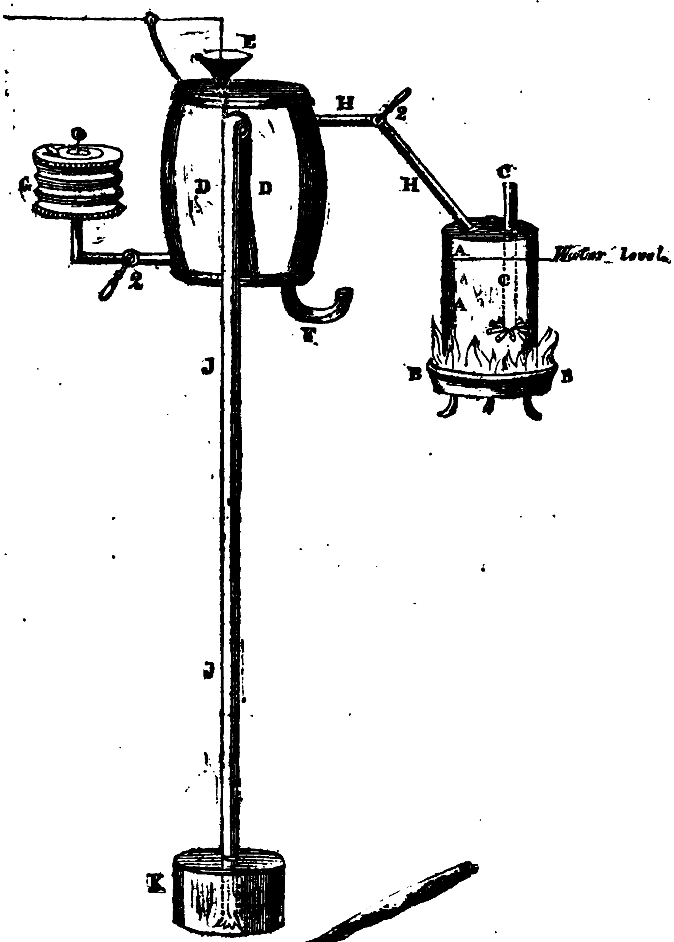
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 102.] SATURDAY, AUGUST 6, 1825. [Price 3d.

"All born alike, from Virtue first began
The difference that distinguish'd man from man:
He claim'd no title from descent of blood,
But that which made him noble, made him good:
Warm'd with more particles of heav'nly flame,
He wing'd his upright flight, and soar'd to fame;
The rest remain'd below, a tribe without a name." *Dryden.*

APPARATUS FOR RAISING WATER.



APPARATUS FOR RAISING WATER

SIR,—As your valuable Magazine appears to be open to experimentalists, as well as to practical men, I trust you will find the following communication worthy your notice. I found, by repeated experiments, that after filling a (wine) bottle with boiling water, and then turning it bottom up, the air that passed into the bottle as the water ran off, became rarefied to double its bulk or volume; for immersing the bottle neck downwards in cold water, it became half full of water in a short time. I then pursued the experiment in the manner described in the prefixed drawing, and found the result similar to that in the bottle.

Description of the Drawing.

AA, a tin boiler, about twelve inches deep, closed at the top, containing two or three gallons of water kept boiling by the fire in pan BB.

CC, a tin pipe, one inch and a half bore, soldered into the top of AA, and passing down about seven inches into the boiling water. At the bottom of CC are several small tubes, intended to make the passing air spread through the boiling water.

DD, a nine-gallon beer cask, having two strong additional heads, and the upper *original* head perforated with holes to let the condensing water spread like a shower bath; the whole cask made air-tight by pasting paper twice over it.

E, a small funnel, with a water-tight plug on the top of DD.

F, an inverted syphon, kept full of water, which covers a water-tight plug or valve.

G, a pair of bellows, with a valve opening upwards; connected below is a copper pipe, one inch and a half bore, passing into the lower part of DD.—There is an air-tight cock added to this pipe at Q, and another on the pipe HH (connected with the tin boiler, AA), which passes into the upper part of DD.

The copper tube, II, conveyed the raised water into DD, near the top, in order to complete the condensation; I then began by letting a *little* water in from the funnel, E, above, still keeping its *plug* under water. Then followed the

Operation.

The boiler, AA, being close, and having no communication with the atmosphere but through its pipe, CC, I first opened my air-tight cock, QQ, then made a few strokes with the bellows, G. The moment hot air came out of its valve, I stopped the air-tight cocks, then let in a little water from the funnel, E, and the water rushed up instantly through the tube, II, and filled the nine-gallon cask about one-half. To let the water off, I opened the cock in the pipe H, and it all ran off through F. I made some strokes very rapidly after the pipe, II, became full. I have given you the experiment as I made it, but it now appears to me that the bellows had better blow into CC; then both the air-tight cocks might be removed, and a much simpler mode substituted in lieu of them.

I am, Sir,
Your obedient servant,
Z.

The writer adds, in another communication to us—"I believe this experiment to be original. It succeeded beyond my most sanguine expectation, the work not being of the best kind, and my workman a carpenter's apprentice. Its simplicity is obvious for raising water, because any quantity of atmospheric air may be rarefied and condensed by keeping about ten gallons of water boiling: the steam-engine requires a boiler proportionate to the power produced."

ELASTIC GUM.

SIR,—Your Correspondent, "Mechanicus," seems not to be aware, that the title, "Elastic Gum," is emphatically applied to Gum Caoutchouc, or India Rubber; but as he may not know how to obtain it in a fluid state, it will, perhaps, be acceptable to state the method he must pursue.

Put a small quantity of caoutchouc, sliced very small, into a three or four ounce bottle, and nearly fill the bottle with spirits of turpentine; place the whole in a large saucepan containing water; keep the water boiling, and often shake up the ingredients. When the turpentine seems to be saturated, strain the fluid

through a rag into another bottle; if any of the caoutchouc be not dissolved, add more spirit, and proceed as before. When I dissolved caoutchouc, it was to varnish a small gas balloon. I mixed an equal quantity of boiled linseed oil with the gum, and think it would be advisable in this case also, as it would contribute to keep the leather softer, and more impervious to the water, and makes the varnish much easier to be used, as, without it, the brush which you use will soon be clogged. A quarter of an ounce of caoutchouc will make more than three ounces of the solution by measure; and if it be mixed with the oil, the spirit may, in a great measure, be evaporated, by placing the solution in a warm oven, no cork being in the bottle; but I do not consider that any advantage can be gained from this. In straining, care must be taken to daub the hands, table, &c. as little as possible, as it is difficult to get off.—Sand and water will clean the bottles, table, hands, &c. soonest.

Yours, respectfully,

CHAIN AND TAPE.

Bradford, July 18th, 1825.

FACTS PROVING THE EFFICACY OF SIR H. DAVY'S METHOD OF PROTECTING THE COPPER OF SHIPS BY ELECTRO-CHEMICAL ACTION.

(From the Annals of Philosophy.)

1. The Carnebrea Castle, an Indiaman, belonging to Messrs. Wigram, of 650 tons burden, was protected last spring by a quantity of iron in four portions, two on the bow, and two on the stern, equal to from 1-100th to 1-110th part. She has since made the voyage to India, and was for some time in the Ganges.

She appeared bright and clean during the whole of the voyage out and home; some mud collected on her bottom in the Ganges, but immediately disappeared when she began to sail. She was put into a dry dock about a fortnight ago, and her bottom examined by Sir H. Davy, the proprietors, and various other persons. Every part of her bottom was bright and clean, without a single adhesion of any kind, and, as far as could be judged from the smoothness and appearance of the copper, it had not been at all worn by any chemical corrosion. The iron, which was about an inch and half in thickness, is considered a sufficient protector for two voyages more.

2. The Elizabeth yacht, belonging to the Earl of Darnley, was protected by two pieces of malleable iron in the stern, in May last, equal to about 1-125th of the surface of the copper. After being employed in sailing during the summer, she was examined in November, when her bottom was found free from adhesions of any kind, and apparently untouched. The copper was bright, and even the nails not tarnished. In the course of the summer a few small barnacles had adhered to the rust of iron, which were easily and immediately washed off; but no weed or shell-fish had ever fixed on the copper, which appeared in the same state as when she left the dock.

The following examples we owe to the kindness of Dr. Traill:—

The ship Huskisson, belonging to Mr. Horsfall, was lately in dock, after a voyage to and from Demerara, where she lay some weeks, in a river remarkably favourable to the adhesion of parasitical animals and weeds; yet, when I examined this vessel, her copper appeared perfectly clean, as far as it could be seen, when she was purposely set by the stern in unloading, in order to show her copper at the bows as low as possible. The Captain stated, that before coming into port, while yet in clear water, he had seen her bottom even to the keel, and it seemed to him quite clean. This ship was defended by two bars of malleable iron bolted along the sides of her keel by copper fastenings, which covered about 1-90th of the surface of her copper.

The Elizabeth, a vessel defended exactly in the same manner, with metals in the same proportions, had made the same voyage. Both had been newly coppered when they last left Liverpool; and the Elizabeth's

copper appeared equally clean as that of the Huskisson when unloaded; but as she did not enter a graving dock, we cannot absolutely say whether she was quite clean, especially as the copper of the Dorothy (about to be mentioned) appeared equally so, until she was seen in the graving dock, when the flat part of her bottom was found to be quite covered with barnacles. The copper of the Huskisson, there is reason to believe, was perfectly clean, as was proved in the next case.

The ship Dee—A very large vessel belonging to my relative, Mr. Sandbach. The ship was newly coppered about twelve months ago, and a bar of malleable iron, about 7-8ths of an inch thick, and three inches broad, was fastened on each side of the keel by iron spikes. It covered about 1-90th of the surface of her copper. Since that period she has made two voyages to Demerara, and was, at the conclusion of the last, put into a graving dock, when her copper was found perfectly free from corrosion, and there were scarcely any substances adhering to it, except a very few minute barnacles, near the keel fore and aft. This case shows, that over defence was not the cause of the foulness of the bottom of the Tickler, for both in this vessel and in the Huskisson the proportion of iron to the copper was greater than in that ship. The iron spikes employed to fasten the iron on the keel of the Dee, were so much corroded, as to endanger the falling off of the bars; copper nails are, therefore, to be preferred.

The Dorothy.—Dr. Traill states, that the following particulars of the Dorothy's outfit and return, were communicated to him by his intelligent friend Mr. Horsfall, one of the owners of the ship, in the beginning of May:—

"The Dorothy had been coppered about a year, and had made one voyage to Bombay and back to this port, when, in May, 1824, it was determined to place bars of iron, four inches broad, and one inch thick, along her keel, covering about 1-70th part of the copper, in the expectation that the iron would at least so far preserve the copper from corrosion, that it might be permitted to run a second voyage to India without being renewed, which can seldom be done with perfect safety. The iron extended from one end of the keel to the other, and was fastened on with copper nails with large heads. The Dorothy, thus defended, sailed again for Bombay in June, and returned to Liverpool about a month since. She was put into the graving dock yesterday (May 3), and an examination of her bottom took place as soon as the water had left her.

"The copper appeared no more reduced than at the termination of the first voyage. The iron was diminished generally about three-quarters of an inch in breadth, and from one quarter to half an inch in thickness. At the ends of the vessel, for about two or three feet, the iron was much more reduced than at any other part. It was covered with the usual rust, not at all resembling cast iron, under similar circumstances. The flat of the ship's bottom, from end to end, and from six to eight feet in breadth, was full of fleshy barnacles (*lepas anatifera*) of uncommon length, and a few of the large hard shell species (*balanus tintinnabulum*).*"

Note by Dr. Traill.—We remarked that the specimens of the *lepas anatifera* were considerably larger on the starboard than on the larboard side of the ship. On noticing this to the Captain, he informed us that the larboard had been the lee side of the vessel, almost constantly during the passage to Europe, and consequently most deeply immersed in the water—a circumstance in the economy of these animals not unworthy of notice.

It is evident that in all these last cases, particularly in the ship Dorothy, the proportion of iron has been too large, and the quantity of calcareous earth on the bottom of this ship proves that the electro-negative action has been in excess.

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* Sulphuric acid was used to loosen and detach the shells.

IMPROVEMENT IN THE FORM OF THE WEDGE.

Fig 1.

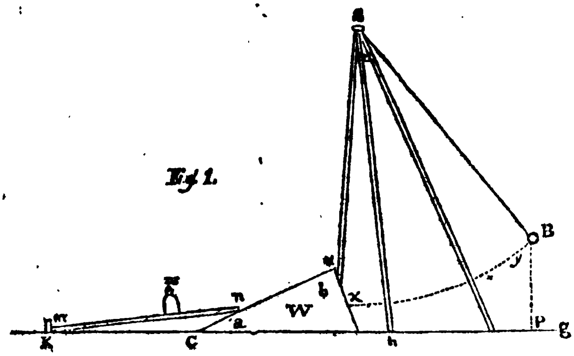
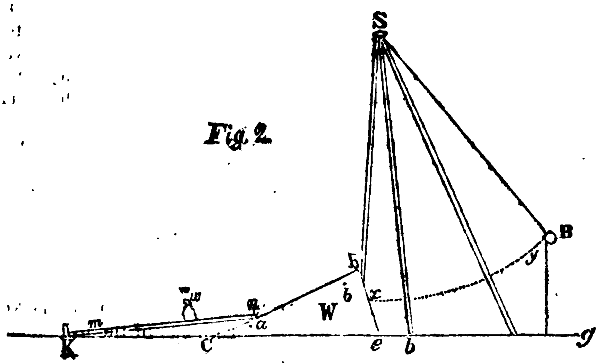


Fig 2.



SIR,—The following is an improvement proposed to be made on the Wedge, exemplified by two experiments, which show how the influence of this mechanical power may be augmented. Considering that it may be of use to those who have occasion to employ wedges in raising of weights, &c. I shall esteem it a favour if you will give it a place in the Mechanics' Magazine.

EXPERIMENT FIRST.

Explanation.

f g is a horizontal plane.

W, a wedge.

m n, a board with a weight on it, to press upon the wedge.

K, a check, to keep the board from sliding back.

S, a stand, with a bob, B, made to swing through the curved line, *y x*.

Having placed the wedge under the end of the board, at a convenient distance, the end, *n*, first touching the point, *a*, the beginning of the impulsive force, let the bob, B, be then drawn back to *y*, directly over P, a mark to which the oscillatory bob is drawn every time of movement till the wedge is driven under the *n* end of the board as far as the point *b* on the wedge.

NOTE.

Size of the wedge one inch and three quarters square at its base, *d*; and length, *c e*, three inches and a half; width, one inch; weight of bob, one pound and three quarters; distance from *h* to *p*, 18 inches; weight of board, with weight on it, 10 pounds; length of string, 4 feet.

The bob being let go, it took 73 strokes to drive the wedge three inches; point *b* coinciding with *n*, for the first experiment.

EXPERIMENT SECOND.

Curve form of the Wedge.

The wedge and position of the other

adjuncts being as before, using the same force, the wedge was driven under the respective weight to the distance assigned in the first trial in only 52 strokes of the bob.

The result of these two experiments suggests some obvious improvements in the ordinary shape of the wedge, for, when of a curved form, as in the second experiment, it is propelled in considerably less time. I conceive that the length of the wedge, *ce*, being $\times\, de$, the height, or, more concisely, $cd^2 \times ce$, when applied to the first instance, is a constant ratio to the momentum (M) on the end, x, but is increased in the second trial by the radius of the curve space on the wedge, now altered, expressed by the initial force C*zd*, or R = C*zd*, by which means the power is gained in point of time, which, by analogy, is as 73 to 52, or, conversely, $\frac{52}{73}$, making about 2-3rds, being 1-3rd of power gained per curve.

If the radius of the proposed curvature were twice the length of the wedge, then $2^2=4$, the effective movement; because the difference between the length of the curve, C*zd*, and diagonal line, C*d* (first instance), $\times\, 4$, produces the same thing; for, by putting g, the greater lineal space C*zd*, and l, the lesser or diagonal C*d*, then $\frac{4g}{4l} = M$ in each experiment, when inversely considered.

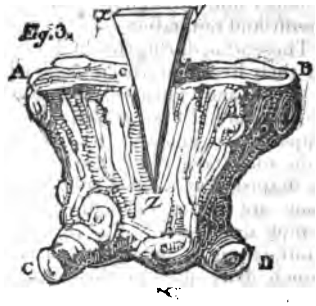
The improvement which I propose in the form of the wedge, is to make one side curvilinear, a curve whose radius is twice the length of any proposed wedge; thus, in raising of weights, &c. in less time by the same power, or in the same time by less power, *i. e.* 1-3rd of time, or 1-9th of power, will be gained in comparison with the straight-lined wedge.

These hints furnish us with another consideration as to the form of a wedge requisite for cleaving of wood, &c. which is to have both sides curved, as in the following figure.*

Explanation.

ABCD is the bottom of a tree sawn off at AB.

xyz, a wedge, curved on both sides, in the act of cleaving.



Now, instead of the common form, admit the sides *xz* and *yz* to be curvilinear, then it should seem that a wedge so formed will cleave the space, *cdz*, in less time, using the same admitted force, than a wedge of the common angled form can possibly do. If, as appears from the previous experiments and calculation, a curved wedge will raise a weight sooner, by a given power, than one of the common form, it follows, by analogy, that one curved on both sides, like the above, will have a double effect.

I am, Sir,
Your obedient servant,
H—— F——.

Fisher's-street, Sandwich.

ON THE ADVANTAGES OF SCIENTIFIC KNOWLEDGE;

BY MR. ROBERT LEWTHWAITE.

Amongst the great variety of subjects which are presented to the human eye, there scarcely exists one more interesting and instructive than that which is afforded by the study of science, especially in tracing the just and wise laws throughout the whole course of Nature; and in this study the mind is not only amused, but inquiry, in many cases, roused, which, if properly pursued, must ultimately arrive at that desideratum which is not only the life of the mind, but, in a measure, the life of the soul; for what persons are there who can observe the various compositions and decompositions which are continually going on throughout the whole creation, the various celestial and terrestrial phenomena that are continually calling forth our humble intellect, and not feel within him a desire for that knowledge which can

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* Our engraver has scarcely done justice to the drawing—the *curvilineal* figure of the wedge is not sufficiently indicated.—EDIT.

conduct him through the world with credit and reputation?

Those who, during the whole course of their lives, have been engaged in a close and unvaried pursuit of wealth, and at first, perhaps, wanted opportunity, and afterwards inclination, to cultivate their minds, are apt to despise that knowledge to which they are strangers; and the contempt they feel is often rendered more strong by the various instances which daily present themselves, of men most famous for their scientific researches, being able to amass but a small portion of that wealth to which others have devoted their whole attention, and in which their whole thoughts have centered.—Foolish, indeed, is the expectation that nothing on this earth but wealth can produce happiness, for, after having enslaved themselves throughout the whole course of their lives in search of that delusive treasure, they find that they are, at the end, as far off as at the commencement of their career.

But how different with the philosopher! Instead of his thoughts dwelling on wealth and grandeur, which are but mere baubles in his sight, he is employed in contemplating the works of Nature, in which he always finds some new phenomenon to account for, or some more striking experiments to attract his attention; and in this pursuit he unites happiness without riches, and instruction without fatigue, whilst those in the pursuit of wealth receive little or no instruction in their career, and, at the end, are deluded by the false phantom they have been pursuing.

The gay and the volatile, who, by their habits, have rendered themselves incapable of serious application, turn away from the sciences with contempt (as they can only be acquired by study), and the neglect they are apt to cherish is strengthened by the deficiency they observe in the humble philosopher, with regard to those graces of politeness which they have been taught to consider of the highest value and importance.

To both these characters of men it may be useful to see clearly stated the real merits of scientific knowledge. The advantages which science produces to those who are distinguished from the rest of mankind by their exalted attainments, are clear and undisputed—the splendour of reputation, and not unfrequently the real benefits of riches and station. On the cases of such men it is not my intention to dwell, though I could point out the varied pleasures they enjoy in the pursuit of knowledge, whilst new phenomena of the most interesting nature are continually being displayed before them, and delightful reflections are perpetually occurring, which fill the mind engaged in this grand and sublime pursuit. The advantages which I intend more particularly to dwell on, are those which may be possessed by common application, assisted by common abilities.

First,—Science is valuable, as it opens to our view and explains the hidden secrets of Nature.

Second, — It is valuable, as it affords an entertaining and highly useful employment for those leisure moments, which, at times, occur to the busiest of men. Whoever has compared his mind as it was in the moments of thoughtless dissipation, when time flew unheeded and undisposed to any useful purpose, with what it was after he had bestowed his time on the cultivation of science, will, I think, be sensible of its advantages; no one, indeed, can deny it if they only allow that the mind will be well employed; for it is generally known, that if a man has not objects to attract his attention, he will naturally turn aside to those vices which are injurious to his morals and constitution, and often pernicious to society.

Science will also be found valuable to a man of middle rank, as it contributes more to his real happiness and tranquillity of mind than the greatest wealth, unaccompanied with a taste for those truly sublime studies which have been so long and so deservedly admired and patronized by the world, and upon which our finest poets have resounded on their tuneful lyres.

It is to science we owe the arts and enjoyments of civilized life. Science is the parent of machinery,

for which we rank the highest in the universe. Take the steam-engine for an example: without that pride of British industry, where would be our manufactories and commerce? How should we be able to compete with our neighbours in the cheapness of merchandise and the beauty of workmanship? Let only these things be well considered, and I think every one will, with me, exclaim

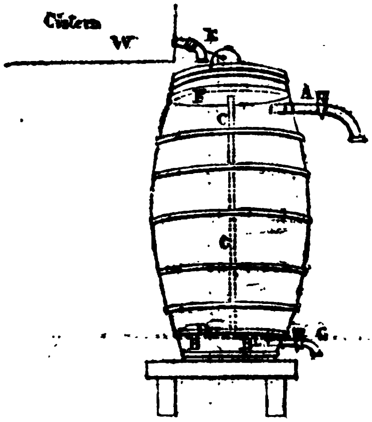
"Philosophia mater omnium bonarum artium est."

In conclusion I have only to remark, that, "next to religion," I consider science the best and sweetest source of recreation in those melancholy hours to which every mortal is liable, and at some time or other must experience. It forms one of the most solid pillars of human happiness, and contributes as much to virtue as to rational amusement.

DISTILLATION OF SEA WATER.

The distillation of palatable water at sea has been effected by P. Nicole, of Dieppe, by simply causing the steam arising from boiling sea water, in a still, to pass through a stratum of coarsely powdered charcoal, in its way to the condenser, or worm tub.

IMPROVED FILTERING APPARATUS.



SIR,—I think your "Improved Filtering Apparatus," in Number 86, may be reduced to one cask, by introducing through its centre a tube, to convey the water from the cistern to the bottom of the cask.

You appear to have no means by which to carry off the "aqueous abomination" that must remain at the bottom of the cask. I think the following would be an improvement on your plan.

G. C.

Manchester, April 20, 1825.

Description.

E, a ball-cock, to regulate the filling of the cask from the cistern, W.

F, a false bottom, to receive the water from the ball-cock, E, and to supply the tube, CC.

CC is the tube through which the water from the cistern, W, is to pass to the bottom of the cask.

BB, the space to receive the water from the tube, CC.

D, the false bottom, as you represent, five inches from the real bottom.

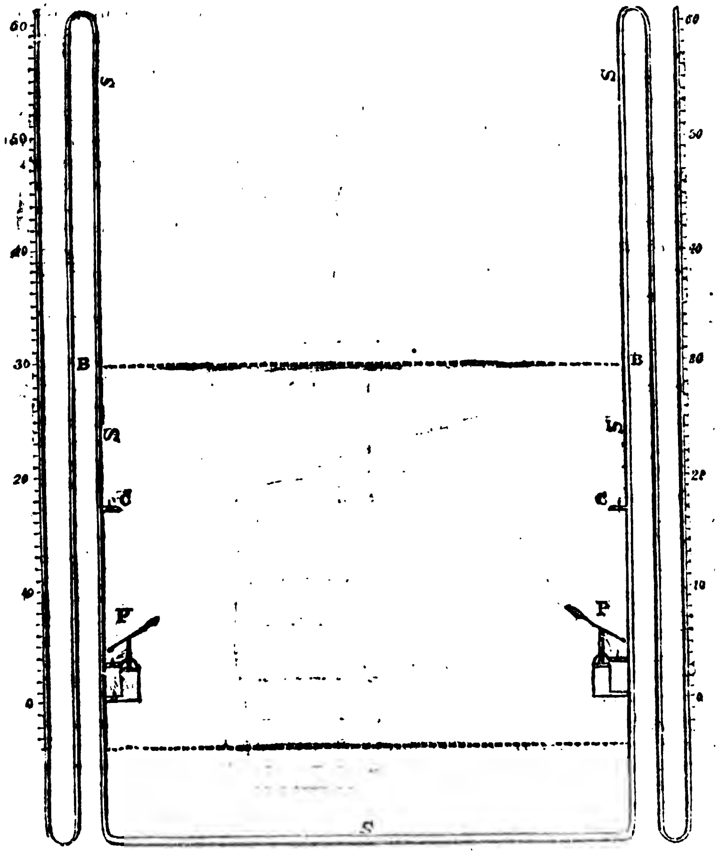
G, a cock to discharge the impure water.

A, a cock to discharge the pure water.

The water should all be discharged, and the cocks left open during one night in the week.

It is not necessary to have a vessel to retain the pure water, as the quantity discharged by the cock, A, will be rapidly replaced.

PNEUMATIC TELEGRAPH.



SIR,—If you consider the above invention of mine, for conveying telegraphic intelligence, worthy a place in your useful Magazine, your speedy insertion of the same will give me much gratification. If I am not too sanguine, this apparatus, if carried into effect, would convey intelligence to the remotest parts of England by the darkest night as well as by the brightest day, and answers would be returned with nearly the same facility and precision as two persons can question and answer each other, sitting in the same apartment. It is also suited to domestic use, for, besides answering all the purposes of bells, it gives the advantage, by a reference to the index, of telling the servants what is wanted, the graduated scale being marked with such things as are usually wanted in a house.

This contrivance would be found of great advantage in cases of fire. Let there be one station in every parish, with pipes leading from thence to every engine-house in the metropolis. At the moment the men hear the alarm-whistle at the engine-houses, let them shut the cocks and look to the index, and the point where the fluid or index rests will mark the parish the fire is in. Let them make another move at

the parish station, and the place where it settles the second time will point out the street. As all the persons on the different stations will receive notice at the same moment, the engines may be directed immediately to converge to the spot.

I am, Sir,

Your obedient servant,

JAMES BUTTERS.

36, Wigmore-street, Cavendish-square, July 6th, 1825.

Description of the Drawing.

BB are two graduated glass tubes, the one at London and the other at Portsmouth, charged with tinted oil.

SSS, a metallic tube which connects the two glass tubes, and extends from London to Portsmouth. It is proposed to lay it eight feet beneath the surface of the earth, where the temperature is always the same, so that no expansion or contraction of pipes can take place.

CC, air-cocks, with whistles to give alarm.

PP, pumps for condensing or rarefying air in the air tubes.

The upper dotted line shows the height or level at which the tinted oil will stand both at London and Portsmouth, when the apparatus is not at work—the lower dotted line, the surface of the earth.

Having described the different parts of the apparatus, it will only be necessary for me to explain the manner of working it. Both the alarm-cocks, with the whistles, must always be open when the apparatus is not at work.

Suppose we want to make a communication from London to Portsmouth, shut the alarm-cock in London, and pump air into the tube SSS, and the air injected will drive the air in the tube under ground to Portsmouth, when it will escape through the cock there and make a loud whistle; the man, upon hearing it, will immediately shut the cock, and the compressed air not being able to escape, will press upon the fluid in tubes BB in both places, and raise it from 30 to 60 in the graduated glass columns, or any point between the two. The figures or characters on the corresponding graduated scales may represent letters, words, or sentences, as may be agreed upon. When the characters or figures to be pointed to stand below 30, instead of pumping air into the tube, SSS, in London, it must be exhausted from it, which, rarefying the air within the air tubes, SSS, the atmospheric pressure will act upon the fluid in glass tubes, and will cause it to sink in proportion to the quantity of air exhausted, viz. from 30 to 0 (in both places at the same instant), or any point between the two.

If intelligence is to be conveyed from Portsmouth to London, what is directed to be done in London must be done at Portsmouth.

CALCULATING WEIGHT OF IRON PLATES.

SIR,—Being constantly employed among iron plates, range backs, &c. and having frequently occasion to weigh them when I want only a rough calculation of the weight, I was induced, in order to save trouble, to use the following manner of calculation, which I generally find comes very near the real weight, frequently within a pound of it.

EXAMPLE.

Suppose I want to find the weight of a cast plate which measures 32 inches long, 20 inches wide, and 1 inch thick. I first multiply the length and breadth together, which gives me the number of square inches contained; I then divide by 4, supposing four square inches of cast iron to be equal to one pound—this gives me the weight in pounds; I then divide by 112, 28, and 4, which brings it into cwts., as under:—

```
        32
        20
      ----
   4)  640
      ----
 112)  160 (1 cwt.
       112
      ----
  28)   48 (1 quarter.
        28
      ----
        20 lbs.
```

By so calculating I find the weight is 1 cwt. 1 quarter, 20 lbs. If the plate is one inch and a half thick, I proceed in the above manner, and after I have divided it by 4, which brings it into pounds, I then add the half of it, then divide it by 112, &c.; but, if it is two

inches thick, I divide the square inches by 2 instead of 4, and so on according to thickness.

I am, Sir,

Your obedient servant,

Norwich. J. W. G.

[We shall be glad to receive our Correspondents' "similar calculations as to round and flat bars, jack weights, round balls," &c.; not that we think them so deserving of adoption, as that they may lead to the communication of some other modes equally simple and still more exact.—EDIT.]

USES OF SALT IN MANUFACTURES AND AGRICULTURE.

Important advantages are now derivable from salt, since it can be procured without duty. In a work published at New York, by Dr. Rensselaer, some of the purposes to which salt may be applied are thus described:—

Sal ammoniac, or *muriate of ammonia*, is made in abundance from common salt. The manufacture of this article was abandoned in England, in consequence of the heavy duty of 30*l.* per ton laid on salt. In consequence, however, of bittern, from the salt works, being allowed in Scotland for the manufacture, the price has been reduced nearly one-half.

In the manufacture of *glass*, salt is largely employed: soda, which is procured from common salt, is used for plate-glass; potash, for flint-glass; and common salt, with kelp, for crown-glass.

Oxymuriate of lime, and other oxymuriatic salts employed in bleaching, are made from salt, and consume a large quantity of it in the manufacture.

Spirit of salt, or *muriatic acid*, requires large quantities of salt: at least 1000 tons are used for this purpose in England every year, notwithstanding the enormous duty. It is used in a variety of processes in dyeing and calico-printing.

Glauber's salt is made from what remains in the stills after the distillation of muriatic acid. This residuum was formerly thrown away, until a person employed it in making Glauber's salt, when a duty of 30*l.* per ton was laid on the article manufactured, since, however, remitted.

Epsom salt is produced entirely from salt, or the evaporation of sea water. The brine, which yields 100 tons of salt, gives from four to five tons of this valuable article. Dr. Henry, the celebrated chemist of Manchester, has discovered a process of preparing it from magnesian limestone, and has reduced the price one-half. It can be made still cheaper from sea water, for the employment of which a duty is laid.

Magnesia is made from salt brine, or sea water. The English duties are so high as to render it probable that both this and the preceding article will, in future, be obtained by Henry's process from magnesian limestone.

Crystallized soda is also made from common salt; and if the latter, or sea water, could be obtained free of duty in England, it would supersede the importation of American or Russian pot and pearl ashes, and 10,000 tons would be used annually, several hundred tons in washing alone.

Barylla, of an excellent quality, is made from salt.

In the manufacture of *hard soap* salt is a necessary ingredient.

Corrosive sublimate is always made from common salt.

Patent yellow is also prepared from common salt.

In the *Fisheries*, in salting provisions for the sea service and for exportation, salt is largely employed.

Butchers, *morocco dressers*, and *skinners*, employ it in large quantities.

[Dr. Rensselaer here calculates that, in England, three times the present quantity would have been eaten if there had been no duty.]

Farmers use great quantities in making butter and cheese, and for steeping wheat to prevent smut.

In *glazing earthenware* much salt is consumed, and is far preferable to the preparations of lead, which are liable to be dissolved by vinegar and eaten. In England the manufacturers of earthenware sometimes pay one-twelfth of of the real amount of their sales for salt.

Salt is likewise employed by iron-founders in metallic cements, and in rendering bar iron very malleable. It is used by whitesmiths and cutlers in

case-hardening, in tempering files and some other edge-tools; mixed with other substances, for reducing metallic ores, assaying minerals, and rendering metals fusible, by the refiners of silver, and to prevent the oxidizement of some metals. It is used to moderate the flame of combustible bodies, and is extensively employed by the philosophical and manufacturing chemist, and by the druggist for a variety of pharmaceutical purposes.

In *horticulture* salt is much used, particularly in England, where its merits are better appreciated than with us. It prevents the depredations of insects on fruit trees, and, when properly applied, protects them from the honey dew. Persons ambitious of having good cider orchards should dig a small trench a few yards from each tree, and place within it a few pounds of salt, which by the rains is gradually conveyed to the roots, and produces most desirable effects.

PROTECTION OF COPPER SHEATHING.

At a recent meeting of the Royal Society, there were read, "Further Researches on the Preservation of Metals by Electro-chemical Combinations; by Sir Humphry Davy."

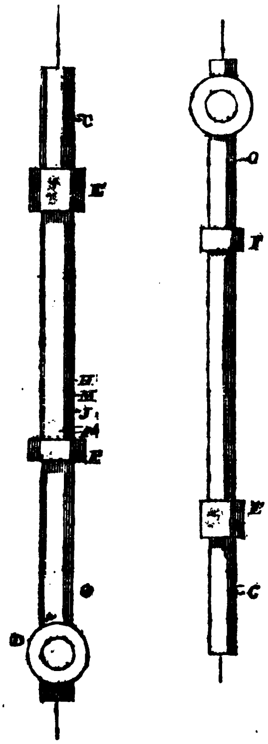
In this paper Sir H. Davy enters into a minute detail of the causes which operate in producing foulness, as it is called, or the adhesion of weeds and shell-fish to the copper of ships. This he attributes to a crust of carbonate and submuriate of copper, and carbonate of lime and magnesia, which gradually fix upon the sheathing, and which, by rendering the copper in the surrounding parts positive, occasions its corrosion, so that ships are sometimes found, in the common course of wear, foul in some parts, and the copper worn in holes in other parts.

He conceives that proper protection, if not in excess, by producing a similarity of electrical state, or of disposition to chemical change in every part of the copper, will prevent the rapidity of its wear without giving it any disposition to foulness; but if iron or zinc are used in such quantities as to save all the copper, then they will increase the disposition of that metal to become covered with weeds and shell fish, except in cases of rapid motion, such as in steam boats, where the chemical action of sea water upon copper may be entirely prevented without the possibility of the copper becoming foul.

The President describes a number of experiments, which show that the most rapid motion does not interfere with the principle of protection. He ascribes the relations of this property of electro-chemical agency to the conducting powers of metals and of fluid conductors; and he shows that a certain contact with fluid conductors, even upon a small scale, is sufficient to enable oxidable metals to preserve more difficultly oxidable metals, and that *slight* chemical changes are sufficient for the effect. Iron in a solution of brine which contains no air is very slowly acted upon, and yet iron in brine in one cup will preserve copper in sea water in another cup, provided they are connected by a moist thread of cotton. He points out the limits to this kind of action, and illustrates it by a very curious experiment. If of two vessels containing salt and water connected by moist cotton, and forming an electro-chemical series by means of zinc and iron, a few drops of solution of potash or soda be poured into that containing the iron, the action of the iron on the sea water will be diminished, but the copper will still be protected; but if the solution containing the iron be made alkaline to any extent, the copper will begin to corrode, and the iron will become the electro-negative metal.

Sir Humphry ends this paper by the important practical conclusion, that copper may be preserved by nails, or masses of zinc or iron placed *under* the sheathing, and that, in this way, there is less loss of the oxidable metal, which is partly revived upon the interior of the copper, so that the same metal will act for a long time; and thus protectors may be applied to save the whole or any portion of the copper without interfering with the external surface of it, and without the deposition of any matter likely to cause adhesion.

KATER'S PENDULUM.



Sir,—As many of your readers may be ignorant of the principle of this instrument, I send you the following extract from Whewell's Mechanics:—

"In order to find the length of a second's pendulum, we must find the distance between the centres of suspension and oscillation of the oscillating body. The difficulty is to determine the latter point, on account of irregularities of density and figure.

"To avoid these sources of inaccuracy, Captain Kater has employed the property of a compound pendulum, to prove that the centres of suspension and oscillation are reciprocal. It follows, from that property, that if a pendulum have two centres of suspension and oscillate on them, first with one end uppermost, then with the other, so that the times of oscillation in both cases are equal, the distance between these two centres will be the length of the equivalent simple pendulum, whatever be the irregularities of form or composition in the instrument. The manner in which this effect was produced was as follows:—A brass pendulum, CD, was furnished with two axles, from which it could be suspended, one passing through C, and the other through O. Besides the principal weight, D, it was provided with a smaller sliding weight, F, which could be moved along the stem, CD; and this weight was to be moved till the number of oscillations, in a given time (as 24 hours), was the same whether the pendulum was suspended from C or from O. F was placed in such a position, that, by moving it from O as to F, the number of oscillations about C, in twenty-fours, was increased; and by the same change the number of oscillations about O, in the same time, was still more increased. The adjustment was thus made:—Let the weight be at F, and let the number of oscillations in ten minutes, about C, be 606, and about O be 601; now let F be moved to f, and let the oscillations in ten minutes be 607 about C, and 609 about O (because the latter are more affected than the former); then the proper position of the slider is somewhere between F and f. Let it be placed at f, bisecting Ff, and let the oscillations in this case be 606½ and 606; then the proper position is between F and f', and so on. Observing always, that if the number of vibrations about C be greater, the slider must move towards C; and if the contrary, it must move towards O. By this means, continually halving the distance last moved, we may make the oscillations about C and O approach within any required degree of exactness; the distance between C and O being then measured, will give the length of a pendulum which makes a known number of oscillations in ten minutes."

I am, Sir,
Yours respectfully,
F. R. A.

A PLAN DESIGNED TO ACCELERATE THE DISCOVERY OF PERPETUAL MOTION.

SIR,—So much has of late been said on this subject, that, in all probability, many of your readers are heartily tired of it, and will treat what I am about to advance with the greatest contempt. However, since all that has or can be said will not amount to a proof of its impossibility, perhaps some of those who are in the habit of thinking for themselves may not yet be quite convinced that it is such.

To them I would say, let us for a moment reflect how much the long list of impossibilites has of late years been reduced, and then ask ourselves, if we have not reason to hope for a still further reduction? A few years back, it was impossible to raise ourselves more than a few feet from the earth, or to immerse ourselves with safety in the depths of the ocean; and it was equally impossible to traverse its surface to any extent, unless favoured by wind or tide. We can now, however, soar above the clouds, explore the depths of the ocean, and skim over its surface, in spite of wind and tide. And be it for ever remembered, that we owe these and many other advantages to a few persevering individuals, who were, in all probability, stigmatized as chimerical visionaries by those who seem to have an unconquerable propensity to condemn every thing above the level of their own understanding.

If by perpetual motion nothing more is meant than the putting in motion some of the most durable substances with which we are acquainted, in such a manner as to ensure a continuance of that motion as long as those substances will resist the effects of time and friction, I do not despair of seeing it accomplished. Our rapid advances in scientific knowledge, together with the advantages likely to be derived from the "British Invention Company," give us reasonable ground to hope, that the time is not far distant, when even this impossibility must yield to persevering ingenuity. In the present state of public opinion with regard to its practicability, it would be looked upon as an empty boast, were I to assert that the discovery is already made*; I will therefore only venture to propose the following plan, which appears to me likely to expedite so desirable an object.

Let some well-known public-spirited individuals commence a subscription, and apply the produce to the erection and furnishing of separate work-shops, expressly for the use of those who do not possess the means of putting to the test of experiment any design they may conceive likely to produce the desired effect. Every model made in these shops will belong to the Institution, and should be preserved and properly arranged in a convenient place, appropriated exclusively to their reception. I will not trespass on your valuable pages by specifying the rules, &c., applicable to such an Institution, or by pointing out its advantages, further than to observe, that if it were only to produce a collection of unsuccessful models, accessible to the public, it would be highly beneficial, as it would be the means of preventing any further waste of time and money on what had already proved ineffectual. But it can scarcely be supposed that it would fail to contribute materially to the progress of science; and as the whole community participate in the advantages derived from science, so every individual (however deficient in original ideas) may, by supporting this Institution, have the gratification of contributing to its advancement.

Such an Institution would be an honour to the country, and though it may not produce the desired effect, it would doubtless be the means of making many valuable additions to our present stock of mechanical knowledge; and we should not, as was the case with the discovery of the New World, have the mortification of seeing it achieved by means

* The person who can raise a weight of six ounces to the height of thirteen and a half inches, merely by the descent of four ounces only twelve inches, ought to be allowed to assert that the discovery is made.

of the patronage and support obtained from another nation, after it had in vain been solicited from us. And here let me remind your reader, that it was the outcry set up by the Antivisionaries, Antichimericals, and Co., those inveterate foes to every kind of discovery and improvement, that deprived us of the honour and emolument derived from that brilliant discovery, and who still continue to do more injury to society in one year, than has ever been done by the visionaries in a whole century. I cannot conclude without expressing my unqualified approbation of the Mechanics' Magazine. May it ever continue a vehicle of conflicting opinions, until we arrive at truth on every subject, is the sincere wish of, Sir,

Your very obedient servant,

PERSEVERANTIA.

Worfield.

SUSPENSION RAILWAY.

SIR,—As the subject of Railways has lately been much agitated, and the attention of the public turned to them in no small degree, perhaps it would not be amiss to give place, in your valuable Magazine, to the following abridgment of a newspaper paragaph; it will be only a companion to a late paper on the subject, to which you have given place; and by its insertion you will not only oblige an old correspondent, but perhaps many more, who, having time and inclinaon, would feel a pleasure in taking a trip to see it, the distance not being very great. T. M. B.

"A line of railway on the suspension principle, invented by Mr. H. R. Palmer, has been constructed for practical use, at Cheshunt, in Hertfordshire, by Mr. Gibbs, of that place. The line of railway runs from the high road at the lower end of the village, through Mr. Gibbs' land, to the river Lea, and is nearly a mile long. It consists of a single elevated line of surface, supported upon vertical posts of wood, fixed in the ground in a peculiar manner, to render their position secure. These posts are at the distance of about ten feet from each other, varying in height according to the undulation of the ground, so as to keep their upper extremities parallel with the necessary plane. In a cleft on these are laid reverse wedges, on which rests a line of bearers of wood, the upper surface of which, covered with a plate of iron, forms the road for the passage of the wheels. The average height of this road above the ground is from two to three feet. The carriage has two wheels, one placed before the other, and two receptacles for goods, which are suspended, one on each side, the centre of gravity being below the surface of the rail. A number of these carriages are linked together by chains, and a horse is connected with the whole by a towing-rope attached to the foremost machine. The most striking peculiarity of this plan is its extreme simplicity, considering the many obvious advantages it presents beyond the ordinary double rail-road, particularly the great expense it avoids in embankments, culverts, and drains; the trifling space of ground it occupies; the increased effect which can be produced upon it, from its reduced force of resistance; its comparatively small cost; its facilities of loading and unloading, &c. Each carriage contains an oblong box (for passengers or goods), suspended on either side of the rail line, and a quantity of bricks is stowed beneath the seats for ballast; thus one horse drew forty passengers, besides an immense weight of bricks. One carriage, which has been constructed for the purpose of trying the application of the plan to the conveyance of passengers, differs from the others. Its boxes partake partly of the shape of a gig, and partly that of a balloon-car; in each are two cushioned seats, *vis-à-vis*, with a little dickey behind, the whole carriage being covered with an awning."

ELECTRICAL EEL.

A specimen of the *gymnotus electricus* has lately been examined by the Parisian *savans*. The greater number were satisfied with a single touch, and consequent shock; but

one doctor, either urged by a greater zeal for science, or governed by a more insatiable curiosity, resolved to try the utmost extent of the animal's powers, and seized it with both his hands, but had quickly reason to repent his temerity; for he immediately felt a rapidly repeated series of the most violent and successively increasing shocks, which forced him to leap about in the most extraordinary manner, and to utter the most piercing screams, from the agony that he felt. He then fell into convulsions, in consequence of which his muscles became violently contracted, as, from some strange property in the fish, it became impossible to detach the animal from his grasp. In this situation he remained a considerable time, and would in all probability have expired under the agony of his sensations, if some of the persons had not suggested the plunging of the hands in water, when the eel immediately dropped off. The doctor has since been dangerously ill.

USE OF SUGAR AS AN ANTIDOTE TO LEAD IN CASES OF POISONING.

The following fact has been stated by M. Reynard to the Société des Sciences of Lisle. During the campaign of Russia, several loaves of sugar had been enclosed in a chest containing some flasks of extract of lead. One of these flasks having been broken, the liquid escaped, and the sugar became impregnated with it. During the distresses of the campaign it was necessary to have recourse to this sugar; but far from producing the fatal results which were expected, the sugar formed a salutary article of nourishment to those who made use of it, and gave them a degree of vigour and activity which was of the greatest service in enabling them to support the fatigues of marching. Hence M. Reynard thinks that sugar might be adopted for preventing the effects of subacetate of lead, instead of the sulphates of soda and of magnesia, which are not always at hand.

LONDON BRIDGE.

SIR,—I feel obliged for the insertion, in the 97th Number of your valuable little work, the Mechanics' Magazine, of my letter of the 13th June, giving my idea as to the plan to be adopted at the new London Bridge, and which I had oftimes before stated to the public, but without effect. I find that my suggestion has now been attended to by the persons concerned in that building, and that a resolution is come to, on the part of the City, to make the bridge four feet wider than the plan at first adopted. This will be a great accommodation to the public, although I could have wished it six or seven feet wider, instead of four.

I hear, from good authority, that the additional expense is estimated at 25,800*l.*, but surely this cannot be an object in a work of such magnitude and benefit to the nation.

I am, Sir, yours, &c.
A PROMOTER OF IMPROVEMENTS.
East-place, Lambeth, 18th July.

CORRESPONDENCE.

T. M. B. will please to send on Monday to our publishers, for the explanation he requires.

The communications of our friend J. H. *have* been received; one has been inserted, and the others will probably have a place very soon.

We shall be glad to hear monthly from Mr. Lean.

A letter has been forwarded to Amicus Veritatis, as directed.

Communications have been received from Philo-Montis—W. G x —Mr. Wm. Spencer—N. H.—G. R.—Mr. Farley—A. B.—Clio—A Journeyman Carpenter at Royston—Caasi Llab—E. B. (Skipton)—Isaac B.—L. H.—C. N. B.—Augustus—Henry Jones—F. B.

**** Advertisements for the Covers of our Monthly Parts must be sent in to our Publishers before the 20th day of each Month.*

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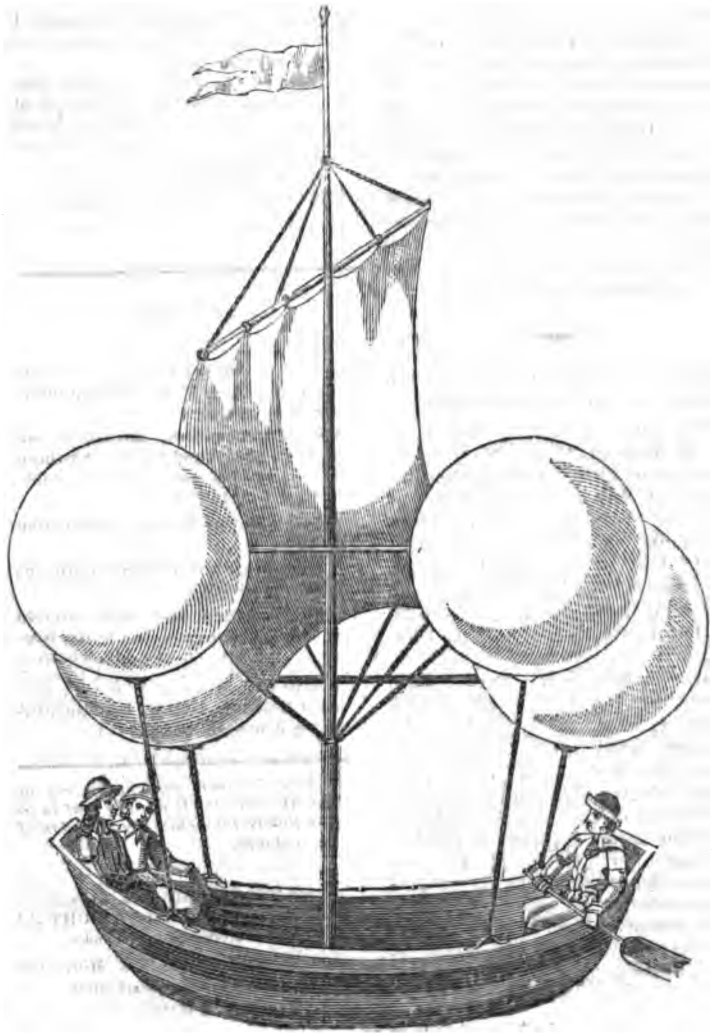
" Even though strength should fail, still boldness shall have its praise ; in great attempts it is enough to dare."—*Propertius.*

AN AIR BALLOON,

INVENTED IN THE SEVENTEENTH CENTURY.



AN AIR BALLOON, INVENTED IN THE SEVENTEENTH CENTURY.

Sir,—The various excellent inventions given in your estimable work, for the purpose of saving lives from shipwreck, must render the Mechanics' Magazine a peculiar favourite with all nautical men; and I should certainly, ere this, have laid the following Plan before you, had I not supposed it more generally known than I find it is, by some communications I have lately had with several nautical men of rank; and I find the truth of their opinions still further corroborated by Mr. Higginson's remark, that "of the art of aerostation, although acknowledged wonderful, has been always heretofore described as useless."

When I was in Germany, on my way home with those specimens of the *Ruta Baga*, which I had the happiness to introduce into England, in 1797, and for which I was voted an honorary member of the Norfolk and other Agricultural Societies, I had the singular felicity of being introduced to the celebrated mathematician, M. Von Mendlesheim, at Stettin, on the Oder, who showed me a drawing of a balloon, in a scarce work, published by John Christopher Sturm, bearing date 1701. It is drawn and described as used by the inventor, and two others, many years previous, for the purpose of bringing them on shore from a ship anchored off Windaw. The whole plan is developed by the author in Latin; and as it covers about nine or ten quarto pages, very closely printed, I must refer your readers to the book itself, which is entitled, "Collegium Experimentale, sive Curiosum, &c. &c. secunda vice publicum adspicere voluit Johannes Christophorus Sturmius,&c. Norimbergæ, sumptibus Wolfgangt Mauritii Endteri. Typis Johannis Ernesti Adelbulmeri, anno M.DCCI." It commences thus:—"Tentamen X. Inventum P. Francisci Lanæ singulare, hoc est, naviculæ per aerem remis velisque agendæ possibilitatem, planiore ac simpliciore modo commonstrans."

This and the drawing (which is as exact as I could make it from the original) are all I copied from the work; and I transmit it to you with pleasure, in the hope that some of your numerous scientific Correspondents may be able to make it available in all cases of shipwreck upon a lee shore.

I am, Sir, very respectfully,
Your obedient servant,
Thomas Macfarlane.

Gressnal, July 9th, 1825.

P.S. It is remarkable, that the term Balloon was not new in the 17th century. In the "*Ship-wracke of Jonas*," one of the poems translated from Du Bartas by Sylvester, 4to. 1592, is the following couplet:

"Against one ship, that skips from stars to ground,
From wave to wave (like *windy balloones* bound,") &c.

BOAT AND BARGE NAVIGATION.

Sir,—In the 86th Number of the Mechanics' Magazine, we are apprised of the formation of a Company, for the purpose of applying Mr. Brown's Gas Vacuum Engine to the purposes of Boat and Barge Navigation; and that they have offered premiums for models, &c.

Not knowing how to address a direct communication to the Company, I shall feel obliged by your allowing me a corner of the Mechanics' Magazine, to inform them, and all other similar Companies, that I am in possession of an invention, which I would undertake to apply to any well-built boat or barge, on condition, that if the machinery did not propel it at the rate of fifteen miles per hour on smooth water, and at the rate of ten miles per hour, against the current of any of our navigable rivers, then I should not be entitled to any remuneration. Beneath, you will perceive my real name and address, which I request may remain at your Publishers, for the satisfaction of those who may desire further information.

I am, Sir,
Your most obedient servant,
P.

PRIZE CHRONOMETERS.

SIR,—I am led to intrude once more upon your pages, though, from the nature of my avocations at this moment, it is with much inconvenience to myself that I do it; but a few errors having slipped into a communication which appears in Number 100 of your Journal, under the head of "Prize Chronometers," I feel it incumbent on me to notice them.

The writer of that article asserts, that "a chronometer is not the production of a single mechanic, but the result of the combined labours of many," and he therefore protests, &c. The fact stated by your Correspondent is admitted, but the argument deduced from it is too fallacious to impose on any one at all acquainted with the process of making a chronometer. It may deceive those who, having imbibed certain ideas of *manufacturing*, imagine that articles of every description and quality are to be got together by that process, whether they be those of our general commerce, the instruments of science that are used in conducting that commerce to the remotest parts of our globe, or the spurious imitations of these instruments, which are manufactured so as to resemble them in external form, but which are as unlike them in internal excellence, as "Hyperion to a satyr." The merit of machines of this description may truly be said to appertain to no particular individual, no higher order of mind having been engaged on those parts on which their excellence must depend, than in the manufacture of the brass and steel of which the whole are composed; and I apprehend that any manufacturer who is so disposed, may claim all the honours of such machines, without any detriment to the various workmen employed.

The fallacy of your Correspondent's argument consists in the assumption, that chronometers, like ordinary watches, or any indifferent article of commerce, may be manufactured by any person who shall have acquired the knowledge of transmitting the various parts from workman to workman, until the arrangement of the whole be complete. But admitting, for the sake of argument, this to be a fact, what are the *honours* that *exclusively* belong to the manufacturer? He may know nothing of the trade he is carrying on; instances of which occur in most trades, and in the watch trade among the rest; his only merit, then, in such case, must be the possession of capital. In all other cases his merits will be in proportion to his practical knowledge and experience in his profession, and to his skill in the selection of the workmen he employs, *where there may happen to be a choice.* Now, if a chronometer were a simple machine, that required no extraordinary skill to execute one part more than another, and the manufacturer had any opportunity for the display of judgment in the selection of workmen, then, indeed, would your Correspondent's argument have some foundation in reason; for no individual workman could then claim honours which must exclusively belong to his employer. This, however, is not the fact, and I fear your Correspondent's protests will be but of little avail.

The perfect chronometer is one of the highest order of instruments of science, and to these instruments the term *manufacturing*, in its generally understood sense, is completely inapplicable; the various parts of which they are composed may, indeed, to a certain extent, be manufactured, but the judicious arrangements of these parts, in which the merit of the whole machine, when complete, will consist, must be confided to some master genius.

An engineer constructs a bridge, or an architect a custom-house; the one, from the peculiarity of its construction, chokes up, to an inconvenient extent, the water-way; the other, from the rottenness of its foundation, tumbles about your ears. The engineer and the architect, in these cases, may, or may not, be in fault; but however that may happen, no person in his senses ever thinks of charging the defects upon the hewers of stone and drawers of water employed on these works; and if they cannot be charged with the defects, neither can they, on your Correspondent's own showing, have any claim to the merits: and, by parity of reasoning, it may be proved, that in the construction of an instrument of science, wherein different degrees of talent are engaged, the merit of the whole must depend on the highest order employed, to whose genius alone the others must necessarily be subservient. *If this degree of talent belong to a manufacturer or shopkeeper, he is entitled to all the honours, not as a manufacturer or shopkeeper, but as a practical workman in the highest branch of his profession, as the master-genius who has given perfection to a machine, the inferior parts alone of which he employed others to execute.*

I know not if this reasoning will be sufficient to convince your Correspondent of his error, but I flatter myself it will satisfy the majority of your intelligent readers, who will perceive that the consequence of this gentleman's generalizing system is to annihilate all distinctions, in cases where a division of labour exists; it is to place the intelligent mason on a level with the plodding labourer who carries the hod; it is to pluck a jewel from the diadem of the artist, who has been raised by his splendid genius to a glorious immortality, and divide it with the uncouth daubers whom he may have employed to prepare his ground-works. I might have furnished a triumphant refutation of your Correspondent's argument, by an investigation of the different degrees of talent engaged in the making of a chronometer; but I have chosen to avoid the invidiousness of such a task, by a recourse to general and analogical reasoning. In the few distinctions and preferences that I have been compelled to make, I must declare, that I have no intention to undervalue any man's talent; all are useful in their respective vocations. If your Correspondent imagines that I had any intention to undervalue his merits as a manufacturer or a shopkeeper, he is mistaken I have only to observe to him, that Mæcenas had his merits as a patron, but Horace had much greater merits as a poet; and the due honours may be claimed for the one, without at all depreciating the just demands of the other. Your Correspondent may apply this as he pleases.

Much has been said of the responsibility of masters, none of which the workman has to bear. This argument, like the former one I have noticed, is more showy than sound. Pray, Sir, are not workmen responsible to their employers for the quality of their work? Does not the workman stand in the same relative position to the master as the master does to the public? If the genius of the manufacturer, manifested in the excellence of the goods he manufactures, be the quality that recommends him to the public, the genius of the workman is, in a similar degree, his recommendation to the manufacturer; and there is as much responsibility on the one part as there is on the other. A manufacturer *ignorant of his profession* does, indeed, expose himself, for a time, to a greater degree of reponsibility, as his ignorance may be taken advantage of by the dishonesty of any workman who may be so disposed; but I apprehend your Correspondent will not, for a moment, contend that he incurs a superior responsibility on this account.

The proposition regarding the compact between masters and workmen is only true in an abstract sense; times and circumstances may at one period make the workmen the slaves and dependents of their respective employers; at another, the masters may be placed in a complete state of dependence upon their workmen. When the supply of active talent and industry is less than the demand, the possessors of it may take it to the best market; but when this supply is in excess, they have not then the same power. But all this argumentation about the relationship of masters and workmen, has really very little to do with the question in dispute; unless, indeed, this inference is meant should be drawn—that your Correspondent employed workmen to make machines, which, after they were so made, became his property, and which property he was entitled to use as he thought proper. If your Correspondent's argument does not mean this, it means nothing; and if it does mean this, then, I say, that this is the sum and substance of the only accusation ever made against him, and which accusation is what he pleases to call a vilification of character, and is to justify the application of any epithets which he, in his moderation, may think fit to adopt. As to advising, I must declare that I had no idea of giving any advice on the subject; I questioned, it is true, the suitableness of the language to the occasion, and ventured to suggest a mode that would have been more satisfactory and conclusive: this, it seems, has brought upon me the charge of impertinence—a thing of but little consequence in itself, and which only shows what has been shown a thousand times before, that it is much easier to call a man impertinent than to answer his arguments. I do not mean to imply that your Correspondent could not answer what I urged; on the contrary, I believe he could have furnished a very satisfactory reply: that he has not done so, must, I suppose, be attributed to that *prudence* which prevents him imparting his knowledge through any other medium than that of his machines.

Your Correspondent attaches much importance to the circumstance of the Royal Observatory being open alike to all. I have little doubt but that he very innocently imagines, that the

practical workman, who, in nine cases out of ten, must make his machine expressly for the purpose of competition, has an equal chance with the manufacturer or dealer, who has an opportunity to select from a quantity. If any faith is to be placed in rumour, your Correspondent's *men*, as he calls them, *have joined in the competition*, and have been distanced in the chase. As an illustration of your Correspondent's beautiful theory of equality, take the following example:—A. makes a machine on his own account; he does every thing that genius and industry can accomplish to render it as perfect as possible; it turns out to be very good, but is nevertheless found, on comparison, to be inferior, in a trifling degree, to one selected from a number of similar machines which the said A. may have previously made for B. What is then the result? Why, the machine that A. has made for B., and which, by purchase, has become the property of B., bears away the prize from the machine that A. has made on his own account; what is worse (and which is the only thing to be complained of), bears away the honours also, it not being known generally, that the merits of this machine belonging to B. are to to be placed entirely to the account of A.'s genius. If the object of a public competition were to excite emulation and to reward talent, among practical workmen, the end would be quite as well attained, by admitting machines made to the order of carpenters or undertakers (or, indeed, of any person who might choose to incur the expense of procuring them), as it is by the present mode. I do not wish to be understood as censuring that mode—my only object is to place it in its true light, to give to it all the merit to which it is entitled, but no more. Defective as it is, much good has been produced; but it cannot, I think, be denied, that if those machines only were admitted which bore the names of the actual makers, the art, as an art, would be more effectually promoted. I would, however, say, rather than that no stimulus should be given, let the present system be continued; "real workmen" will, to a certain extent, continue to try their powers, notwithstanding the inequality of the race they must run with the manufacturers; but if they expect any thing more than to give publicity to their qualifications for the art they profess, they will be deceived. I will not hesitate to declare, that the practical workman who shall send a chronometer to the Royal Observatory, under the impression that he has an *equal* chance with those who call themselves manufacturers to a *large* extent, will be a fitter subject for a lunatic asylum, than to be employed as a chronometer-maker. He *may* win, as the purchaser of a lottery ticket may gain a 20,000*l.* prize, but, on a calculation of chances, the odds will be always against him.

I am at a loss to conceive the object of your Correspondent, in ringing the changes so much on the subjects of *jealousy*, *envy*, &c. Is he addressing himself covertly to some rival manufacturer? He cannot, surely, mean that the "real workmen" are envious of his talents. Besides, if his having gained a prize of 200*l.* could excite their envy, those who have gained 300*l.* must be objects of envy in a still greater degree, as their presumed merits must be proportionably greater. Be this as it may, the application of your Correspondent's very *apt* quotation from the poet, will not fail to be duly appreciated by all. I am charged by your Correspondent with wishing to *insinuate* that he is ignorant of the instrument which the term chronometer is intended to express. I have no wish of the kind; I do not deal in insinuations: all that I mean to say, I say openly and fearlessly. I showed that your Correspondent made a very equivocal use of the term chronometer; and what is his reply? Why, that "had I made myself acquainted with the *derivation* of the word, I should not have risked such an assertion." I can assure this gentleman, that my compendium of useful information had made me acquainted with it some years ago. It happens, however, to have nothing to do with the subject; and a reference to it on my part would have had no other utility than that of proclaiming my knowledge of two Greek words—a piece of affectation for which your Correspondent, or any other person, might very properly have charged me with pedantry. The word chronometer has, in our language, a conventional meaning, and is as capable of as clear a definition as any word we possess. Where then is the necessity of going to derivations? Why, according to your Correspondent's reasoning, an hour-glass *might* be called a chronometer; but *is it* so called? If it might not be considered *impertinent*, I would ask your Correspondent, whether, when a gentleman enters his shop, and desires to look at a *chrono-*

meter, he shows him an *astronomical clock?* or whether he himself, wanting an astronomical clock, would go to a practical clock-maker, and desire him to make him a chronometer? Really, Sir, if there be any truth or reason in your Correspondent's application of terms, it must be admitted, on all hands, that our mechanical nomenclature requires to be reformed, as the chemical one has been; for, in the present acceptation of the term, where is the person carrying a chronometer in his pocket, who imagines that he wears an astronomical clock? But your Correspondent ultimately limits his application of this term, and tells us, that "*every* machine to which the compensation for heat and cold is *properly* applied, whether it be in the balance or the pendulum, *may be* strictly termed a chronometer." Now philosophically argumentative as this "*may be*," I would ask, *is* every machine of the description just given so called? If these machines are not indiscriminately termed chronometers, of what utility is your Correspondent's "may be"? All this floundering about, in the use of vague and indefinite language, can answer no other purpose than that of introducing into our minds the confusion of Babel; by an application of your Correspondent's logic, the various terms by which differently constructed ships are designated, as also those of various articles of our domestic economy, would be involved in as delightful a disorder as the demon of anarchy could wish.

I have not now time to examine this part of your Correspondent's argument in a way that it would be useful to the public it should be examined. Frauds are occasionally practised on the unwary by the misapplication of language. No person is in danger of having a duplex watch, with a compensation for heat and cold, imposed on him as a chronometer, by a tradesman of your Correspondent's respectability, but his reasoning would justify such a proceeding. In conclusion, Sir, I have only to observe, that if there are persons who would excite an undue prejudice against your Correspondent, I am not one of them. My motives were clearly and distinctly stated in my former letter. The competition at the Royal Observatory is a public matter, and the public are interested in knowing the merits of the various competitors. "*Palmam qui meruit ferat*," is my motto; and I presume to think, that when the palm has been won, the merits of the winner may be inquired into, without at all subjecting those who make the inquiry to the suspicion of being actuated by malice or envy, or any other uncharitable motive.

I am, Sir,
Your obedient servant,
G. MUSTON.

Fleet-street, Aug. 1, 1825.

NEW STEAM ENGINE.

WE very lately noticed a newly invented Steam Engine, a patent for which has been obtained by Mr. Eve, in the United States. We have since had an opportunity of witnessing the operations of a model, which Mr. Eve has had constructed for the purpose of elucidating the principle of his invention. Mechanism is a subject of such importance, and the inventions and theories of the present day are so numerous, that we approach such subjects with diffidence. We will, however, endeavour to explain the construction of this engine; and the first thing deserving notice is the simplicity of the motion, which is rotatory. It consists of but two moving parts, both of which revolve, and are similar to each other, and a steam generator. It has no parts in common with the steam engines in use. No cylinder, piston, valve, cock, fly-wheel, crank, condenser, or any reciprocating parts whatever. It is impelled by the direct impulse of the steam acting on surfaces at right angles with the motion, so as to appropriate its whole power under the most favourable circumstances. There is the least possible friction, as there are no parts that rub or touch but the pivots. Its velocity is unlimited, so that, with the smallest conceivable force acting, the greatest power required can be obtained, by which means an engine of a very small size may be made to perform almost any given quantity of work. We scarcely need say that it is a high pressure engine. We refrain, at present, from a particular notice of this part of the machine, as a steam generator is about to be made on a plan of Mr. Eve's, different from any thing used in this country.—*Liverpool Courier*.

WORKING STEAM TWICE—BREWING —OZZANAM'S PUMP.

SIR,—I see three Papers in your Journal of the 23rd July, to which I beg leave to reply.

1st. Page 243. On *Working Steam twice.*—In the double cylinder steam engine, as well as in all others, the power is gained by the *difference* of the pressure of the steam on each side of the piston. For instance: suppose the high pressure cylinder has steam in it acting on the piston at 45 pounds per square inch, the steam, on the other side of the piston, counterpoises with a medium pressure of (we will say) 30 pounds per square inch, in consequence of its being allowed to commence expanding, by the motion of the engine, into a large or low pressure cylinder, the moment it has done its duty in the first: this expansion is constantly decreasing what I will call the *antagonist* pressure, during the whole stroke, until it sinks to about 15 or 17 pounds per inch at the end of it, and the steam is then of sufficient elasticity to work the second or larger cylinder, on Bolton and Watt's principle; and this second power is gained by condensing the steam on one side of the piston in this cylinder, whilst the elasticity of 15 or 17 pounds on the other side carries it through the stroke: therefore, the moving power in the first or high pressure cylinder is equal, by supposition, to (45—30) 15 pounds per inch, and the same steam in the second cylinder produces a further power, of nearly equal intensity, per square inch; but as the size of the piston in the second cylinder is much longer than the first, the power of the former may considerably exceed the latter. It is, however, more than probable that if the steam from the high pressure cylinder were discharged into a separate vessel, sufficiently large to allow it instantly to expand to about 17 pounds per square inch (or to its common elasticity in the boilers of condensing engines) before it entered the low pressure cylinder, an extra power might be gained; that is, the steam, as it escapes from a high pressure engine, may be employed to work a condensing engine without further expense; and if these two engines are placed sufficiently near to each other that the same beam, pump-rods, &c. &c. may serve for both, it would then become a double-power engine.

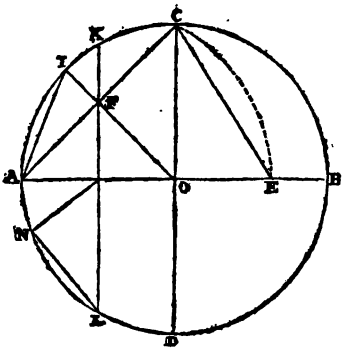
2d. *Brewing.* Page 245.—Your Leominster Correspondent says that he "never met with any malt that would produce one hundred pounds of saccharine matter per quarter." I think the cause of his deception is in his employing a common brewing saccharometer, which merely gives the *difference* of weight between a barrel (36 gallons) of wort and a barrel of water; but this is a very different thing to the quantity of dry saccharine matter contained in that barrel of wort, which may, however, be at all times discovered by multiplying the indication, per saccharometer, by 2.5; that is, two pounds and a half of the dry saccharine extract of malt, when dissolved in 36 gallons of water, will merely exhibit one degree, or one pound, by the saccharometer. It is true that 200 pounds of saccharine matter from a quarter of malt are rather an excessive produce in country situations, because the maltsters will not clean the malt sufficiently from the roots and dust attaching to it before it is measured; but the London brewers generally buy their malt by weight, or after ascertaining that it is sufficiently screened to weigh from 37 to 40 pounds per bushel.

3d. *Ozzanam's Pump,* page 252.—I have long had a pump on this principle at work, for the purpose of raising a variety of liquids, and I much approve of it, with this single caution, which I advise all persons to keep in mind who have any intention of employing it; viz. that the pump be always fixed sufficiently low for the fluid to run by its own pressure into the working chamber, or there will be a difficulty in what is technically called "fetching it," should the valves at any time leak.

I am, Sir,
Your obedient servant,
J. HAM.

Somerset.

GEOMETRICAL METHODS OF PRODUCING PENTAGONS, HEPTAGONS, ETC.



Sir,—Mr. G.A.S., in No. 77, page 324, of your valuable Magazine, has said, that "he is not in possession of any method, strictly geometrical, to produce the pentagon, heptagon, nonagon, &c." I beg leave to communicate the following methods; not in the least disparaging his laudable design to simplify geometry, and to reduce it to a level with the practical mechanic, but rather to facilitate the same, should the methods be approved of.

To find the side of any regular polygon, from a trigon to a duodecagon, that may be inscribed in any given circle, suppose ABCD.

First, through the centre, O, draw the diameter, AB, dividing the circle into two equal parts.

Second, take in your compasses half the diameter, AO or OB, and setting one foot in A, with the other mark K and L, and draw the line KL, which will be the side of a triangle that may be inscribed in the circle.

Third, draw the line, CD, through the centre, O, cutting the diameter, AB, at right angles, and then draw AC, the side of a square that may be inscribed in the circle.

Fourth, set one foot of the compasses in G, and extend the other to C, and draw the arc and chord, CE, which will be the side of a pentagon, that may be inscribed in the circle.

Fifth, any of the semidiameters, AO, OB, &c. are the sides of a hexagon that may be inscribed in the circle.

Sixth, half the line KL, namely KG or LG, are the sides of a heptagon that may be inscribed in the circle.

Seventh, divide the line, AC, into two equal parts in F; draw the line, OFI, cutting the circumference of the circle in I; join AI for the side of an octagon.

Eighth, divide that part of the circle, LAK, into three equal parts; one-third part is from L to N; then a line drawn from L to N will be the side of a nonagon (or figure of nine sides).

Ninth, the line OE is the side of a decagon.

Tenth, the line NG is the side of an undecagon that may be inscribed in the circle; and the lines AG, GO, are the sides of a duodecagon that may be inscribed in the same circle.

I am, Sir,
Your humble servant,
C. K.

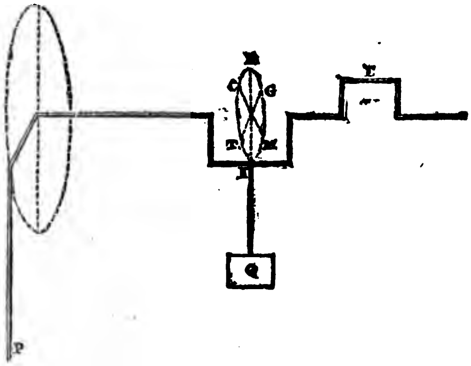
Pembroke Dock, July 9th, 1825.

WATER CHURN.

Sir,—In No. 98 of your valuable Journal, I perceive a new species of Churning Machine invented, which appears to be a useful contrivance; but it has often occurred to me, that running water might be made use of to assist in churning, to great advantage, particularly in large dairies; and I should consider that a wheel, on the same principle as that of a water mill, would be of infinite service, and save much manual labour. The barrel might be formed after the model of the common barrel churn, and a bolt might be easily contrived to stop the wheel at pleasure. If you consider this hint worth inserting in your columns, I trust that some of your able mechanical Correspondents will put the above machine in motion, or treat more largely on the subject.

I am, Sir,
Your most obedient servant,
S. R. C.

ADVANTAGES OF A DOUBLE CRANK.



SIR,—I send you the substance of a chapter in "Venturoli's Mechanics," as I think the subject of which it treats has not been noticed in your valuable work.

When it is intended by the continued turning of a wheel to produce an alternate motion, a crank is frequently made use of. This is most commonly the case in wheels employed for the purpose of raising the pistons of hydraulic pipes. The rod of the piston is attached to the elbow F of the crank. As the wheel turns round, the point F rises to R, describing the semicircle FGR; it afterwards returns to F, through the opposite semicircle RTF; and thus the piston rises and sinks by turns.

In this movement, even when the moving force is equivalent to a constant weight P, and when also the force of the piston is equivalent to a constant weight Q, hanging from the arm of the crank, the motion cannot be uniformly accelerated; because, whilst the piston ascends through the semicircle FGR, the arm of the lever of the weight Q is continually changing: it is nothing at the point F, it is greatest at the point G, where it is equal to the breadth CF of the crank, and it vanishes at the highest point R. Whence it is easily seen that the motion will be continually accelerated, but by less and less degrees in the first quadrant FG, and then by greater and greater degrees in the second quadrant GR.

The result of a mathematical investigation is, that when a weight is raised by means of a crank, the arm of the lever, at the end of which it acts, may be considered as constant and equal to 7-11ths of the breadth of the crank.

The ascent having been completed, the descent follows through arc RTF, which brings back the piston to the point whence it set out. In this descent the moving power P does not at all oppose the weight Q. When the crank is employed to raise the pistons of tubes, the piston, after reaching the highest point R, descends by its own weight, and does not exert any force on the machine. Hence, during the whole time employed by the crank in returning and bringing back the elbow to the lowest point, the moving force is idle: to avoid this, a double crank is used, as in the figure.

By inserting this you will oblige your constant reader,

O. F. F.

QUICK TANNING.

SIR,—In your first Volume, under the head of "Quick Tanning," you give a short notice of an invention by a Mr. Spilsbury, of Leek, of a new method of tanning hides, in a wonderfully short space of time; but you have said nothing about it ever since, although I have been expecting to see some notice of it in almost every Number. I take the liberty, therefore, of requesting

that, if you know any thing further respecting this discovery, you will communicate the same through the medium of your valuable Magazine; or if Mr. Spilsbury should see this, perhaps he would be kind enough to say something of it, as I, and numbers of my *brother chips*, would be very glad to hear more about it. If it really performs what your first volume states it does, it must be a very curious invention indeed.

I am, Sir, yours respectfully,
An Old Tanner.

P.S. My attention has been more particularly drawn to this subject lately, in consequence of my having been informed by a friend, that a patent Machine for Tanning had been somewhere exhibited in Lambeth, but that was the extent of the information I could get. Whether it was Mr. Spilsbury's or not, or any thing further, I could not learn.

WASHING MACHINE--EXPLANATION.

Sir,—A Correspondent, signed Islington, in Number 89, page 78, desires a further explanation of my Washing Instrument, described at page 424 of your third volume of the Mechanics' Magazine.

The points, CD, rest upon the bottom and opposite side of a wash-tub, which is the frustrum of a rectangular pyramid standing upon its lesser base. The washer's brush rests upon the curved part, AB, and by so doing gives a great support and strength to the body of the washer. So much water is put into the tub as to allow part of the flutes to be above water. Dip the linen in the water, and soap it upon the dry part of the board; then with both hands rub the linen upon the flutes. By this method the washer is enabled to do double the work, compared with the usual method of rubbing one hand against the other. The flutes also tend to keep the lather suspended until the dirt is removed; consequently there will be a saving of soap.

I am, Sir,
Your humble servant,
Rd. Burton.

Cottingham, July 18th, 1825.

MANAGEMENT OF BEES.

Sir,—Should you again agitate the inquiry concerning the best method of managing Bees, I think the following may be noticed:—

It is the common practice to place the hives where the sun has the greatest influence,—such as beneath a south wall,—and to let them remain in the same situation during the winter. For the summer this is all right; but as the winter approaches, the hives should be placed where the sun never appears. It is not so much the degree of cold that injures the bees as the variations. Under a south wall the sun is sometimes powerful, even in the depth of winter; thus the bees are roused into action, and are ill prepared to meet the extreme cold of the night. Besides, when lying in a torpid state, which they do during the coldest weather, the bees do not require so much food; and I am led to believe that the cold is not so excessive during the night where the sun has not shone during the day; but even allowing the reverse, still I think that as the degrees of cold are less variable, the north side of a house or wall is the preferable situation during the winter. Nor should the bees be removed into the sun until the trees have so far shot forth their buds that they may find a sufficient repast.

I think those hints may be useful to those who would wish to become practical apiarists. My knowledge of the matter is theoretical; but I have friends who follow the practice.

I am, Sir,
Your obedient servant,
R. H.

CASE OF THE SHIPWRIGHTS.

Sir,—The insertion of my Letter in Number 96, published June 25th, has produced replies from "Moderator," "A Friend to Truth," and from "John Gast, Shipwright." The first of these Letters hardly deserves an answer; his talents resemble his trade; and unless he makes a better use of them, are likely to remain *stationary*. Next in order comes "A Friend to Truth." He appears

to be not exactly a shipwright; but we may call him a carpenter, if we may judge by his *chips*, and a tale-bearer, according to his own story. His reply forms no extenuation—palliates nothing; but, on the contrary, develops more fully the ignorance and self-willed obstinacy of the operative shipwright, in striving to gain an ascendancy totally at variance with their calling and station. The object of their ambition, according to this writer, or tale-bearer, is to be no longer men dependent upon their masters, the medium through which they derive employment from the public, but to make their masters entirely subservient to their will. Last in order comes "John Gast, Shipwright;" to whose letter I shall proceed to reply, less from respect for him, than for a set of men who, I firmly believe, are grossly misled, and might, and can do well, if they only follow the dictates of their own minds. John Gast premises, by stating, that shipowners have not suffered loss by the combination of shipwrights for increased wages, and as, by his showing, wages did not form the bone of contention, *but a matter of right founded upon reciprocity*—such as employing men whom *they* consider best qualified for their contract work. This explanation, so vastly intelligible, might do for the London stationer, "Moderator;" but what will your readers think when I assert, without fear of contradiction, that carpenters have been, by these Union men, continued so, with as much pertinacity as the absence of actual force would admit, who did not possess the qualification of a raw apprentice. The Shipowner has seen caulkers also at work with like pretensions. This glaring misconduct, coupled with other regulations as to hours, according to John Gast, justifies, by no means, any complaint from a shipowner. We have also a piteous story about attending to dock ships, without being paid for their tide's work; this, to use homely language, is like the boy quarrelling with his bread and butter. We have next an exordium upon the superiority of workmanship in the river Thames. I, as a British subject, should like to see them maintaining superiority; but the carpenters of America, I grieve to say, leave them behind an immeasurable distance; and on the Continent, work has been done (barring the ornamental) equal to the work of the river Thames in durability, if not altogether so pleasing in appearance. Practice, according to one of the soundest axioms of political economy, leads to perfection; and we may, ere long, from the obstinacy of our own workmen, see those of our Continental neighbours surpass our wishes and expectations. Hitherto repairs, to any considerable extent, could not be effected abroad without losing the privileges of British registers; but the Legislature has granted a great relief, by suffering repairs, to any extent, to be accomplished abroad, for the space of two years; a measure which the evidence on the combination laws rendered highly expedient. But I will not pollute your pages by making quotations from evidence so disgraceful to the operative mechanics.* Next comes a violent tirade against shipowners, because reference was made to the wages workmen obtain. Shipowners, according to Mr. John Gast, get from seventy to ninety hundreds a year, and *that through the mental and physical acquirements of the operative shipwrights*. He might, in his zeal for first causes, have stated with equal truth, that they gained this sum per annum *through the mental and physical acquirements of the tool-manufacturers*. I, as a shipowner, know of none who have made money through this instrumentality. Some few, by their talent, connexion, and information, have made money as shipowners; but for one that has been successful, ten have been the reverse. But further, it is said, shipowners

* We have read the evidence, and can see no pretence whatever for thus characterising it. On the contrary, we think that, in general, it does great credit to the intelligence and good sense of the men; displaying, of course, much of the blunt homeliness of expression common to their walk of life, but nothing of which they have the least occasion to be ashamed of.—EDIT.

are a mercenary class, and inimical to the interest of the working or operative mechanics. If patronizing every institution which has for its object the diffusion of knowledge amongst them, aiding genius in the means of maturing and bringing to light the fruits of the mind, display a mercenary spirit, I am bound to plead guilty. I look forward to the diffusion of knowledge as the best and surest source of securing the comforts of the labouring class, as it will enable them to think and to act with discretion, instead of suffering the disgrace of being led by such individuals as those to whom they now yield obedience.

I am, Sir,

Your obedient servant,

A Shipowner.

STEAM NAVIGATION.

Sir,—As Steam Navigation has lately become of great national importance, any contribution towards its improvement, however small, may be considered a desideratum; it is with this idea that I venture to submit to you a few remarks on the subject. All your Correspondents that have written on this subject hitherto, strongly object to the use of paddle wheels. Now, in my opinion, the fault lies in the mode of constructing and applying them, and not in the paddle wheels themselves; as I will endeavour to prove. The common method of applying paddle wheels to steam vessels, is to place them close to their sides, by which their power of propelling the vessel is considerably retarded by the quantity of water the vessel displaces constantly running to restore the equilibrium; add to this the effect produced by the ridiculous practice of crowding a number of floats upon the wheels, and the loss of power must be considerable. I think these evils might be remedied, if the following plan were adopted. Let the paddle wheels be made in two parts, each two-thirds the width of the common ones now in use; each part to have four floats fixed to it at right angles to each other; let these two parts be fixed on the shaft, about three feet from the vessel's side, in such a manner that the floats shall be at an angle of 45 degrees from each other; by which means, I imagine, the paddle wheels would lose none of their propelling power; which is not the case at present. Should I be in error, I shall be glad to be corrected by any of your more able correspondents. I am aware it may be said, that the additional width of the paddle boxes would make the vessel appear cumbersome; but, as I think it must be allowed that steam vessels do not, nor ever can, appear handsome, I hope this will not be considered an obstacle.

I am, Sir,

Yours truly,

R. Farley.

Rotherhithe.

STANDARD OF MEASUREMENT.

Sir,—I read the Letter from Mr. Pasley, in the 73d Number of your Magazine, and am well convinced of the importance of an invariable and natural standard of measurement; and for establishing such a one, the following plan has suggested itself to my mind:—I am ignorant, if the rays of the sun be admitted through a small aperture into a dark room, whether the shadow will move through the same space, in any given time, at all seasons of the year; but if that be the case, can there, Mr. Editor, be any more natural or any more certain mode of forming a standard of measurement, than by taking the space passed over by the shadow in any certain time; say that the space passed over in one hour shall be a yard. From that measure all others might be derived; and from that measure of length, measures of capacity might also be constructed.

Sir,

Your obedient servant,

Emilla.

QUADRATURE OF THE CIRCLE.

SIR,—I have to thank you for the favour of insertion granted to "Les Egaremens" of an untaught philosopher in that old wild-goose chase, the Quadrature of the Circle; but as that was an attempt by geometrical means, and as mechanics, considered as a body, may be supposed to possess a more competent knowledge of arithmetic, than of the higher branch of mathematics, perhaps the following attempt at approximation, in arithmetical terms, may be agreeable to some of your readers.

Let the side of a square equal ,94, its area shall be ,94²

8116
72

,8836

Let the side of this square be made the diagonal of a new square, and the new shall be to the old as 1 . . 2; therefore its area shall be $\frac{,8836}{2}$ = 4418.

Let the diameter of a circle equal ,75, its area shall be

75²

4925
70

,5625 × 7854 = ,44178750

We can now compare the areas, and estimate the difference, viz.

Square ,4418
Circle 44178750

1250 $\frac{, \ldots .1250}{100000000} = \frac{1}{80,000}$ = one eighty-thousandth part of one square inch.

I remain, Sir,
Your obliged humble servant,
RICHARD DOWDEN.

Blarney-lane, Cork.

HINTS TO PREVENT THE EXTENSION OF FIRES.

SIR,—Observing that at the late dreadful fire, near Cavendish-square, there were three *pumps* within a short distance (say twenty yards) of each other, and in situations where they were afterwards destroyed by the fire, although the very premises where they stood were more than a hundred yards from the spot where the conflagration first began; I beg to suggest a hint, which, if adopted by the fire offices and others, might in future arrest the progress of the devouring element, till the engines can be brought to act, which generally takes up a considerable time. The plan is simply this: Let the offices supply the proprietors of such premises as are ensured with them (or oblige them to supply themselves) with a hose, conductor, &c. which should always be kept hanging against the wall over the pump, or in the nearest convenient place in sight, and which should be examined from time to time, that it might not get out of order. In case of fire in any of the surrounding warehouses or manufactories, this apparatus should be fixed on the pump, which two or three men might work; and if no more can be done than preventing the flames communicating from one part to another, or to other buildings, a great object would still be accomplished. It is very certain, that if such a plan could have been adopted at the late fire, to which I have alluded, it must have prevented the destruction of many thousand pounds worth of property. It would certainly have saved Margaret Chapel, and the coachmaker's and upholsterer's premises, on the south of this most destructive fire; to say nothing of lessening the terror and dismay of the neighbouring inhabitants.

I am, Sir,
Your obedient servant,
A. S.

Margaret Street, Cavendish Square,
July 11th, 1825.

LONDON UNIVERSITY.

SIR,—You admitted in your publication of January 24th some suggestions of mine on the subject of the Improvement of London. With reference to what I then recom-

mended, and which I am glad to see is likely to be carried into effect, I take the liberty now to propose that the site of the intended London University (which, according to one of the Resolutions of the late Meeting at the City of London Tavern, is destined to a central situation) should be fixed in some part of the line of the projected opening from Fleet Market to the Great North Road. Whenever that heap of rubbish, and receptacle for thieves and depredators, the purlieus of Saffron Hill, shall be cleared of its present buildings and population, what a favourable opportunity will it present for the erection of buildings for public purposes, upon a unity of design, and scale of splendour, that will do honour to the metropolis!

I am, Sir,
Your obedient servant,
C. D.

THE FINCH-LANE PERPETUAL MOTION EXPLAINED.

Sir,—I observed some time back in your excellent Work, a supposed refutation of what was stated to be a Perpetual Motion, by a man in Finch Lane. This man stated that he could stop the machine (merely a ball hanging to a long spring), and that it would set itself agoing again without his interference. The machine certainly did this, and at first puzzled me a good deal; and the reason of my writing to you now about it, is to expose the imposition in the proper manner. I may here remark that the man has shown considerable ingenuity, (as I believe the idea to be quite new,) though he certainly is an impostor. It was not till I had visited him twice that I "smelt the rat." Below the ball was an orifice, and through this, the air from without the room was conducted immediately upon the ball, which it set in motion, and continued to accelerate, until it had received, by continually passing over the hole, the full effect of the stream of air. The weather being warm, and yet observing a fire in the room on both my visits, was what led me to the discovery; and on endeavouring to keep open the door by which I entered, the man interfered; but I did so long enough to lessen considerably the motion of the ball, by partly destroying the current of air through the hole. This proved the correctness of my conjecture.

As I dare say the same man is carrying on his mechanical *profession* in some place to which your Magazine may find access, this communication may perhaps save many heads a few hours hard thinking about *this* perpetual motion.

I remain, Sir,
Your obedient servant,
Non-Perpetuus.

DIFFERENT APPEARANCE OF OBJECTS AT HIGH AND LOW WATER.

Sir,—Your Correspondent, J. R. page 245, vol. iv. may perhaps find an answer in the following Reflections, &c. of Mr. Cassini's.

I am, Sir,
Yours respectfully,
R. W. D.

Albany Road.

Reflections on the Observations made by F. Laval at St. Baum, St. Pilon, and other neighbouring Mountains, before the Royal Academy of Sciences at Paris. By M. Cassini, Jun. Dec. 22d, 1708.

The height of St. Pilon above the surface of the sea being found, by observations of the barometer, to be 481 fathoms, an inquiry may be made into the observations of the apparent depression of the horizon of the sea, made by F. Laval on that mountain. The greatest apparent depression of the horizon of the sea was observed on the 25th of June, 1705, at 3 in the afternoon, to be 57—45″, the weather then being hazy, and the wind north-west; the smallest was found on the 26th of June, in the morning, to be 56′—0″, the sky being very clear, and the wind south-westerly. Taking, therefore, a *medium* between these two observstions, which differ 1′45″ from each other, we shall find the mean apparent depression to be 56′ 52″.

Supposing now the semidiameter of the earth to be 3271600 fathoms,

as we found it by our observations in prolonging the meridian, we shall find, that at the height of St. Pilon above the sea, which is 481 fathoms, the real depression of the horizon should be 58′ 57″, which is greater by 2′ 5″ than the mean apparent depression, 56′ 52″. *This excess must be owing to the refraction, which raises the apparent visual ray above the true one, by about the twenty-eighth part of an angle of the mean apparent depression.*

F. Laval remarks that the refraction is greatest when there is a fog in the air, occasioned by a north-west wind; and that it is greater or less as the wind is more or less fresh.

MONNOM'S BORING APPARATUS.

Sir,—I have read with much interest, in your Number 86, the description of a Boring Apparatus by M. Monnom; but as many inventions, however apparently good in theory, may occasion disappointment when practically applied, I request that he will be so good as to state if he has made actual trial of it,—for what purposes,—and with what success. It is to be hoped that he will also be able to furnish an estimate of the probable cost of the machine complete, and to point out where it may be seen at work.

I am, Sir,
Your constant reader,
G. W.

EGYPTIAN ORE.

Sir,—In answer to your Correspondent, "Quibus," in your Number for May last, I beg to say, that during the last year I purchased an article made of the Egyptian Ore; and as it was represented to me that it would wear equal to gold, I ventured to make a present of it to a member of my family; but such is the nature of the metal, that it was very soon discovered (suspected at least) that I had imposed upon the lady. The colour changes miserably, and it does not keep *at all* the appearance of gold.

I am, Sir,
Your obedient servant,
Tho. Harris.

Petersham, July 12th, 1825.

INQUIRY.

NO. 137.—VIOLIN VARNISH.

Sir,—Having completed the making of a Violin, I shall feel obliged to any of your intelligent Correspondents, who would inform me how I could make or procure a good transparent oil varnish, that would not be detrimental to the sound, or destroy the beauty of the wood, as I find the common varnishes have both these qualities.

I am, Sir,
Your obedient servant,
W. Fell.

ANSWER TO INQUIRY.

NO. 134.—VARNISHING STUCCO IMAGES.

Sir,—In reply to the inquiries of "Aurum," I am glad to be able to inform him, that figures made of plaster of Paris may be easily and beautifully varnished by means of the following composition. The proportions which are best, I have not exactly ascertained. I am indebted to some one of the periodical publications for the receipt—to which of them I cannot now recollect.

The materials are *white wax, soap,* and *water.* It is obvious that the wax is dissolved by the soap in the water at a boiling heat. This varnish does not sink in, as that complained of by your Querist: it readily dries; and its effect may be heightened by lightly using a silk pocket-handkerchief. I have employed this varnish with remarkable success to the casts of cameos, which, when thoroughly dry, may be finished by means of a *clean* camel's hair pencil.

On mentioning my method to an Italian who furnishes me with nu-

merous casts, he suggested the substitution of spermaceti instead of wax. I have not tried this substance, but have no doubt that it would answer as well, and probably better.

I have the more readily made this communication to you, in hopes of encouraging your subscribers to collect casts of the various beautiful specimens of ancient and modern art which at this time abound in the country, and shall feel happy if I am the means of assisting collectors in the preservation of them.

I am, Sir,
Your obedient servant,
W. Johns, M.D. F.L.S.
Manchester.

NEW PATENTS.

J. Fox, Plymouth, Devonshire, rectifying distiller; for an improved safe to be used in the distillation of ardent spirits.—May 14.

C. Mackintosh, Crossbasket, Scotland; for a new process for making steel.—May 14.

J. Badams, Ashted, near Birmingham, chemist; for a new method of extracting certain metals from their ores, and purifying certain metals.—May 16.

I. Reviere, Oxford-street, gunmaker; for an improved construction, arrangement, and simplification of the machinery by which guns, pistols, and other fire-arms, are discharged.—May 20.

W. H. James, Coburg-place, Winson-green, near Birmingham, engineer; for certain improvements in apparatus for diving under water, and which apparatus is also applicable to other purposes.—May 31.

J. F. Ledsam, merchant, and B. Cook, brass-founder, both of Birmingham; for improvements in the production and purification of coal gas.—May 31.

J. Crowder, New Radford, Nottingham, lace net manufacturer; for improvements on the Puslew bobbin net machine.—May 31.

J. Apsdin, Leeds, bricklayer, for a method of making lime.—June 7.

C. Powell, Rockfield, Monmouthshire; for an improved blowing machine.—June 6.

A. Bernon, Leicester-square, merchant; for improvements in fulling mills, or machinery for fulling and washing woollen cloths, or such other fabrics as may require the process of fulling.—June 7.

TO CORRESPONDENTS.

The trickery to which "Glasguensis" alludes had not escaped our notice, but we imagined it scarcely deserved exposure. Shortly after the commencement of the Glasgow Mechanics' Magazine, we hailed its appearance most cordially, as a worthy ally in that *new field of usefulness*, in which we were the *first labourers*, and we did say that it was "a clever work," and, "though sold at the same price, is printed on a finer paper, and in a more showy manner, *than ours*;" but we added, at the same time, that "*it did not, on an average, contain one-half the quantity of matter, nor one-half the number of illustrative engravings, that the London Magazine does.*" The Proprietors of the Glasgow Mechanics' Magazine, by publishing in the newspapers the *former part* only of our criticism, and in so far, therefore, grossly falsifying it, have sought to make it appear to the public as if we had voluntarily borne testimony to the utter inferiority of our work to theirs! But who could, for an instant, be deceived by so palpable an artifice? Of its liberality and consistency, in men professing to promote the interests of science and of truth, and indebted to us for the plan of their work, we shall say nothing.

Communications received from—Tyne—J. G.—H. S. H.—A Constant Reader—L. C.—J. H——d—Capt. Hall—H. M. M.—Peter Palisade—Mr. Lewthwaite—C. H.—A. J.—Focus—M. C.—Wm. Hoyle—Henry Christian—Indicator.

ERRATUM, PAGE 271.

For "D, a pulley to support the band, the band going under the roller;" *Read*, "D, a pulley to support the band. The band going under the roller."

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 104.] SATURDAY, AUGUST 20, 1825. [Price 3*d*.

NEW METHOD OF REGULATING THE MOVEMENT OF STEAM VESSELS, INVENTED BY J. AND C. CARMICHAEL.

COMMUNICATED BY CAPTAIN BASIL HALL, R.N.

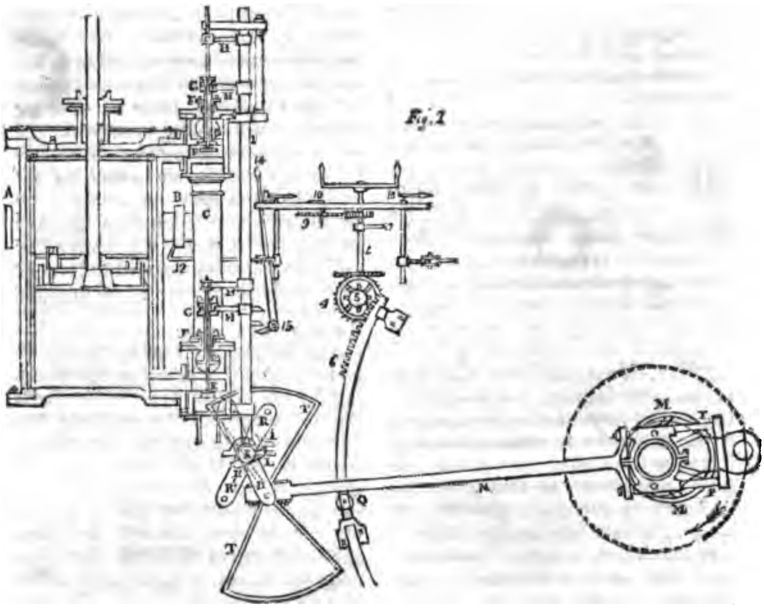


Fig 2

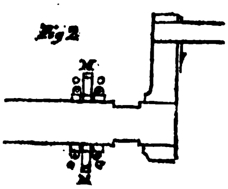
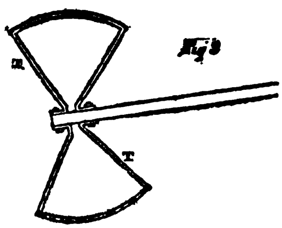


Fig 3



ACCOUNT OF A NEW AND COMMODIOUS METHOD OF REGULATING THE MOVEMENT OF STEAM VESSELS, INVENTED BY MESSRS. JAMES AND CHARLES CARMICHAEL, OF DUNDEE.—COMMUNICATED BY CAPT. BASIL HALL, R.N.

Captain Hall takes the liberty of sending to the Editor of the London Mechanics' Magazine, a Paper recently published (at his instance) by Messrs. James and Charles Carmichael, engine-makers, of Dundee, and will be happy if the Editor thinks it worthy of a place in his work. Captain Hall can assure him, that the beautiful contrivance described does its business most perfectly, and is so obviously applicable to every description of steam vessel, that he has no doubt it will be universally adopted when it becomes known. The ingenious inventors, with the modesty characteristic of true genius, not only never dreamed of taking out a patent, but were apparently unconscious of having accomplished any thing worthy of being made public. If their description, however, finds a place in the Mechanics' Magazine, it will require no farther advertisement.

128, George-street, Edinburgh,
29th July, 1825.

"Sir,—In compliance with your request, we forward you a sketch of the machinery of the George IV. Twin Steam Boat, employed on this ferry, and we shall now proceed to give a description of that part of it invented by ourselves, the utility of which you have frequently witnessed, and which you are pleased to think may not be uninteresting to the scientific public.

"The object of the contrivance we are about to describe, is to regulate the motions of the steam-vessel in a more easy manner than heretofore. By the simple motion of a small handle, or index, placed on a table, upon deck, in view and in hearing of the man at the helm, and of the master of the vessel, every movement which the engine is capable of giving to the paddle-wheel may be at once commanded. The vessel may be moved forwards or backwards, or may be retarded, or entirely stopped, at any given moment, by merely turning the handle to the places denoted by the graduations of a dial-plate. No skill is required for this purpose, so that the master himself, or a sailor under his directions, can perform the office as well as the ablest engineer. Thus, the confusion which frequently arises at night in calling out to the engineer below, is avoided, and any ambiguity, arising from the word of command being transmitted through several persons, entirely prevented. In point of fact, it places the engine as much under command as the rudder is—an undoubted improvement upon the clumsy method of bawling out to the engineer below, who either may not hear, or may chance to be out of the way—circumstances which may lead to the most serious accidents.

"The different parts of the machinery are not exactly arranged in the sketch as they are executed in said boat, but we hope that the principle will be better understood from having arranged them so as they can be better seen in the sketch prefixed.

"The cylinder and jacket are cast in one piece, connected at the bottom, but altogether disconnected at the top when cast; the vacancy between the two is closed at the top by an iron ring, and hemp or rust packing in the joints. The steam from the boiler enters between the cylinder and jacket by the branch A, passes round the cylinder, and communicates with the side pipe, C, of the valve-chests, by the branch B, but cannot enter the cylinder when the steam-valves, DD, are shut. The eduction-valves, EE, are situate below the steam-valves.

"The steam-valve rods work through a flax packing at FF, and are made hollow, to allow the eduction-valve rods to pass up the centre of them; they are also made air-tight by a flax packing at GG.

"The valve-lifters, HHHH, are fast upon the lifter-rods, II, only one of which can be properly seen; the foot of the one farthest from the eye is seen at the rocking-shaft. One

of these rods lifts the upper steam-valve and lower eduction-valve, and the other the lower steam-valve and upper eduction-valve. The lower steam-valve and upper eduction-valve are represented as lifted in the sketch.

"The rocking-shaft, K, turns and returns upon its centre about 40°, and having two spanners (or pallets), L, projecting from it upon opposite sides, causes the lifter-rods and the valves connected with them to rise alternately. The lifter-rods fall by their own weight, and when the pallets are horizontal, all the valves are shut, and for an instant of time are at rest.

"The rocking-shaft receives its motion from an eccentric wheel, M, fastened to the crank-shaft. The fixing of this wheel, with relation to the crank and valves, is a point of considerable nicety, as upon this depends the opening and shutting of the valves at the proper time.

"The eccentric rod, N, is supported on the crank-shaft by a projecting part on each side of the eccentric wheel, turned concentric with the shaft by the brass pieces, O. The four rods, P, pass through these brass pieces, and slide freely in them. This part is shown in the section at fig. 2, with part of the crank (or paddle) shaft, and the crank on one end. The other end of the eccentric rod is supported on the roller, Q; and as the crank-shaft turns round, the eccentric rod travels backwards and forwards a distance equal to double the eccentricity of the eccentric wheel; and as the said rod is connected with the rocking-shaft by the double-ended spanner, RR, on one end of it, consequently the rocking-shaft will travel from one extremity of its arch of motion to the other, in the same time that the crank-shaft makes half a revolution, or in the same time that the steam-piston travels from the top to the bottom of the cylinder, or from the bottom to the top. The steam-piston is represented in the middle of the cylinder, and as the lower steam-valve and upper eduction-valve are open, the piston must be ascending; and as the crank is connected with the opposite end of the walking-beam (or lever), the crank will be descending. By the time that the piston has reached the top, and the crank the bottom, the rocking-shaft will be in that position where the pallets upon it are horizontal, and, of course, all the valves will be shut. But the momentum of the paddle (or fly) wheel carries on the motion, and immediately the two valves that were formerly shut, viz. the upper steam-valve and lower eduction-valve, are opened, and the steam presses down the piston with a force equal to the difference between its own elasticity and the elasticity of the uncondensed vapours below the piston. Thus the engines will continue to go, and the paddle-wheel to turn, in the direction of the dart.

"But that we may endeavour to explain to you the method of stopping or reversing the motion of the paddle-wheel, all that is necessary is to shut all the valves; and this is effected by disengaging the eccentric rod from the spanner of the rocking-shaft, and the valves all shut of their own accord, by the weight of the valves, lifter rods, &c., and the engine will stand: and to set the engine agoing, either the one way or the other, is to lower the eccentric rod, to take hold of the double-ended spanner on the end of the rocking-shaft, as represented on the sketch, and then the paddle-wheel will move in the direction of the dart, or lift the eccentric rod to the top of the spanner on the rocking-shaft, and then the paddle-wheel will move in the opposite direction. The use of the sector-formed appendages, T, on the end of the eccentric rod, is to conduct the pins on the ends of the double-ended spanner into the notches adapted for them on each side of the eccentric rod; the form of which is better seen detached at fig. 3.

"The hand-gearing, for starting or stopping the engines, is situated upon the deck of the boat, and all concentrated upon the top of a small table in view and in hearing of the man at the helm, or the master, who directs both, when coming to the quay.

"1, a double-ended handle, which is upon the upright shaft, 2, on the

lower end of which is a bevel-wheel, 3, working into another wheel, 4; this wheel is on a lying shaft, which extends from the one engine to the other, and carries on each end of it a spur-pinion, 5, which pinion works into the rack, 6. There is a similar rack connected with the eccentric rod of the other engine, into which the other spur-pinion works; so that, by turning the handle, 1, both engines can be started, stopped, or reversed, with the greatest facility and certainty that could be wished for. These bevel-wheels, spur-pinions, and racks, must be so proportioned to one another, as that two complete turns of the handle, 1, raise the eccentric rod from the lowest to the highest position. One turn of the handle raises or lowers the eccentric rods into the stopping position, and one turn, either the one way or the other, as circumstances require it, sets the boat a-head or a-stern. There is a projecting piece, 7, fixed upon the upright shaft, which catches into a notch, pressed by a spring, which supports the racks and eccentric rods, at any of the three positions that may be required.

"As the said upright shaft makes two turns, and always stops at the same point, it is not suitable for the index. To remedy this, there is a small pinion, 8, below the table, working into a wheel, 9, with four times the number of teeth, for carrying the index, 10. This wheel, making but half a revolution for two revolutions of the upright shaft, makes the index upon its arbour stand fore and aft when the engines are going, and thwart ships when the eccentric rods are set in the standing position.

"The index, 11, is connected with the regulating valve, 12, by rods and spanners, and turned by hand, as circumstances require.

"The index, 13, is connected with the injection-cock by rods and spanners, it being always shut before the engines are stopped, and opened when the engines are started. Each engine has separate gearing for the regulating valves and injection-cocks, and graduated circles on brass plates, to show, by inspection, the position in which they are standing.

"When the engines stand for some time, it is necessary to let the steam pass freely through them for two or three seconds, on purpose to heat them, and expel any air that may have got inside. For this purpose, the long handle, 14, standing by the side of the table, is fixed to a shaft, 15, which goes across the front of both engines, and by four short spanners (or pallets) upon it, lifts all the valves of both engines, and allows the steam to pass freely through them by the air-pump valves. The engineer knows by the sound when to replace the handle in the position shown in the sketch; and having previously set the index for the head or stern motion in the direction wanted, and adjusted the steam-regulating index, the last thing he has got to do is to open the injection-cocks, and immediately the engines start in the direction wanted.

"Thus we have, at your request, endeavoured to sketch and explain to you such parts of the ferry twin-boat, George the Fourth, of this place, as you more particularly wanted information respecting. We hope that it is done in such a way as you will understand it; but if any further explanation is wanted, be so kind as write us.

"We are, Sir,

"Your very obedient servants,

"JAS. and CHAS. CARMICHAEL."

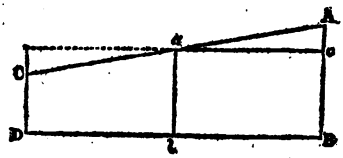
USE OF THE SLIDING RULE.

SIR,—Allow me to point out an error made by G. A. S., page 227, where he says, "that if the piece of timber is tapering, that is, larger at one end than at the other; if it taper regularly, we may measure the breadth and thickness at the *middle* of the log." That this method gives an erroneous measurement, I go to prove.

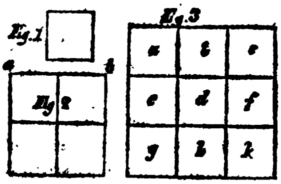
Suppose the lesser end to measure 6 inches square, and the greater 18, and to taper regularly; then at the middle, the square, or quarter girt, will be 12. Now the area of the square of 12 is 144, and the areas

of the two extremes added together make 324, and divided, 162, being a surplus of 18. So the piece, allowing it to be 12 feet long, according to G. A. S., would measure 12 feet; by what I consider the more correct method, 13½ feet nearly.

The error arises from supposing that the surplus of the greater end is just equal to the deficiency of the lesser. In measuring a plane this supposition is correct; for let AB, CD, be the plane, and *ab* the middle, then the surplus, A*ac*, will just make up the deficiency, as seen by the dotted lines.



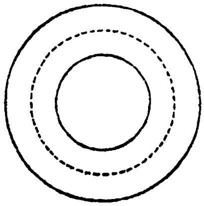
But, in measuring a solid, let fig. 1 be six inches square, fig. 2 twelve inches, and fig. 3 eighteen inches, which accords with the dimensions stated above; fig. 2 being the mean, and the side, *ab*, the quarter girt.



Now, to be correct, according to the plan of G. A. S., fig. 3 should contain just as much more than fig. 2 as should make up the deficiency of fig. 1; but *abcd*, fig. 3, are equal to fig. 2, and *efg* make up the deficiency of fig. 1; therefore *hk* are not included in the measurement, and, consequently, the result obtained is erroneous.

In order to prove the correctness of *taking the mean of the two extreme areas* instead of the mean of the extreme diameters, which is done when the middle is taken, conceive the pieces *efg* cut out and transposed so as to form a perfect log 12 feet long and 1 foot square, then the measurement of the remaining pieces, *hk*, added to the log of 12 feet, will be 13½ feet nearly, as before.

The same is the case in the measurement of round timber; for suppose, in the following figure, the



inner circle to be the lesser end of a stick of timber, and the outer circle to be the greater end: suppose the inner to be 8 inches diameter, and the outer 16, then, according to G. A. S., we should measure the whole piece by the mean diameter, 12, agreeing with the dotted circle. But the mean area of the inner and outer circles is 125½ inches, while the area of the dotted circle is but 113 inches, being a deficiency of 12½ inches; therefore any piece of the above assumed diameters, measured by the plan laid down by G. A. S., and which, I believe, is the common practice, would be deficient by the sum of 12½ multiplied by the length.

To learn and teach is my motto: I have derived considerable improvement from G. A. S., and I trust that he will not be offended at this attempt to prove him, for once, in error.

Believe me, Sir,

Respectfully yours,

R. H.

OBSERVATIONS ON MR. BROWN'S GAS VACUUM ENGINE.

(From the Repertory of Patent Inventions.)

Great expectations have been excited in the public mind respecting this engine, the specification of which appeared in the 45th vol. of the Repertory of Arts (described in No. 53 of Mech. Magazine); but of the wonders which it was to perform, none have yet, I believe, been exhibited in an operative shape; and

we are still to look forward for the fulfilment of its mighty promises.

Many persons at first thought, that in it a real vacuum was to be produced, by burning pure hydrogen in the portion of oxygen proper to produce water; but it turns out that the word vacuum is used on this occasion in an improper sense (which probably caused this error), and that it is intended to denote a degree of exhaustion of the working cylinder of the engine, equal, at most, to a column of 23 or 24 inches of mercury, which is far short of a vacuum.

Coal gas, in this engine, is contrived to be burnt in atmospheric air, to produce the degree of exhaustion of which it is capable (which I doubt much to be so great as stated). This, however, cannot proceed from the mere reduction in volume of the mixed gases burnt, since coal gas, or carburetted hydrogen, burnt in the proportion of 170 parts with 100 parts of oxygen, will produce 100 parts of carbonic acid gas (See *Dr. Henry's Paper on Coal Gas, &c.*); and as atmospheric air contains but 27 parts of oxygen in 100, of course the 73 hundredths of azote left will have to be added to the carbonic gas. Now, as very nearly 373 parts of air will be necessary for the 170 of coal gas mentioned, there will remain, after the combustion, 272·29 of azote, and 100 of carbonic gas, in all 372·29 parts, out of 543, which is, within a very small fraction, one-half of the whole quantity originally introduced.

It is evident, then, that the effect is not produced by the burning out or condensation of the gases, but by the explosion of the mixture, or by the expansion caused by its flame, when this does not amount to what would be called an explosion, though in all cases it is a degree of it.

Here then we come on other grounds, which I am much surprised have not been noticed before in the many publications which have treated of this engine. In the 2d part of the 1st vol. of the Transactions of the Cambridge Philosophical Society (which was published considerably more than a year before the sealing of Mr. Brown's patent), there is an account given of an engine on precisely the same principles last explained, invented by the Rev. Mr. Cecil, of which account there is an extract published by Dr. Brewster, in the Edinburgh Philosophical Journal for October, 1822 (vol. vii. p. 362), that may perhaps be more readily consulted, as being in more extensive circulation.

Of this extract the following is the substance:—"The principle of Mr. Cecil's invention appears to be, that a mixture of one part of hydrogen, and two and a half of common air, will expand, on being exploded, to three times its bulk, and then instantly collapse to a sixth of its original volume.

"A cylinder, with a piston and a light valve at its other end, is the chief apparatus. The hydrogen gas admitted into this, and exploded by a jet of flame through a touch-hole at the side, will drive out the most of the common air from the cylinder by the end valve, which will clap to by the condensation afterwards, and force down the piston, by whose action the other valves, which admit the air and the gas, are opened; when it again rises by the action of a counterweight, or of a fly-wheel, and the same process is again repeated."

On this extract I will leave your readers to make their own comments; only premising that, as the invention was thus evidently first published by Mr. Cecil, whatsoever merit it has is that gentleman's undoubted right. And here I beg leave to state, that all engines, where explosive mixtures are burnt, are most dangerous to the lives and property within their vicinity; and that the mixture of coal gas and air is eminently of this nature, we have too many common examples to need the statement of chemical facts. This must be the case, even where philosophical gentlemen carefully attend to the performance of such engines; what then must be the danger, when left to the management of ignorant labourers? which must, more or less, occur, if they come to be used as first movers for manufacturing purposes.

A paper by Mr. T. Tredgold (which corroborates the foregoing statement), on the theory and power of this engine, and comparing the latter with that of the steam engine, has been published in a late number of the Edinburgh Philosophical Journal, wherein he has entered into some very minute algebraical calculations on the subject, which prove the inferiority of the former. Mr. T. shows, that if oil gas is used with the gas engine, 270 cubic feet of it, at a cost of 10s., will be necessary to produce the effect of a bushel of Newcastle with the steam engine; and that if coal gas be used, that 482 cubic feet of it, at a cost of 5s. 9d., will only have the same power; which even in London, where coals are so dear, will be nearly five times the expense that a steam engine would require in doing equal work.

If worked with oil gas, Mr. T. thinks that a jet of flame, of a temperature equal to 1050°, might be made to fill a cylinder of a small size, and produce an exhaustion capable of sustaining a column of mercury of 20 inches (which, however, is not two-thirds of what a real vacuum would perform); and concludes with observing, that "the advantage of this increase of moving force is, however, not so great as to repay the increased consumption of gas necessary to produce it; and that the exchange of steam boilers from the retorts and gasometers of a gas work, will certainly not be esteemed an advantage; while, for a locomotive engine, the expense would be so great as to put it entirely out of the question, whether it would be better to carry oil gas, compressed to a thirtieth of its bulk, or to use a high pressure steam engine." B.

ELASTIC GUM VARNISH.

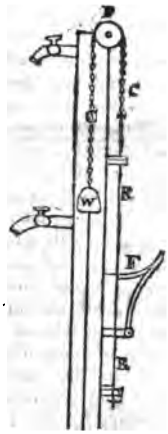
SIR,—In the Encyclopædia Perthensis, article 'Aerostation,' section 5th, "Mechanicus" will find Mr. Blanchard's method of making this composition, which was as follows:—"Dissolve elastic gum, cut small, in five times its weight of spirit of turpentine, by keeping them some days together; then boil an ounce of this solution in eight ounces of drying linseed oil for a few minutes; lastly, strain it—it must be used soon."

I remain, Sir,

Your obedient servant,

THOMAS HENRY BELL.

A CONVENIENT PUMP FOR HOUSES.



SIR,—I send you a sketch of a Pump of my contrivance, for houses, which will be found of great convenience from the little space that it will occupy. It has no handle like other pumps; all that is required is a small pressure with the foot, to raise water to any height required.

Description.

CC, a chain, which runs on the pulley, P.

RR, an iron rod connected with the chain and the pedal, F.

W, a weight that sinks the suction in the water.

I am, Sir,

Your obedient servant,

DIXON VALLANCE,

Mechanic.

MR. H. MATTHEWS'S PATENT FOR THE PREVENTION OF ACCIDENTS BY TWO-WHEELED CHAISES, WHEN A HORSE FALLS.

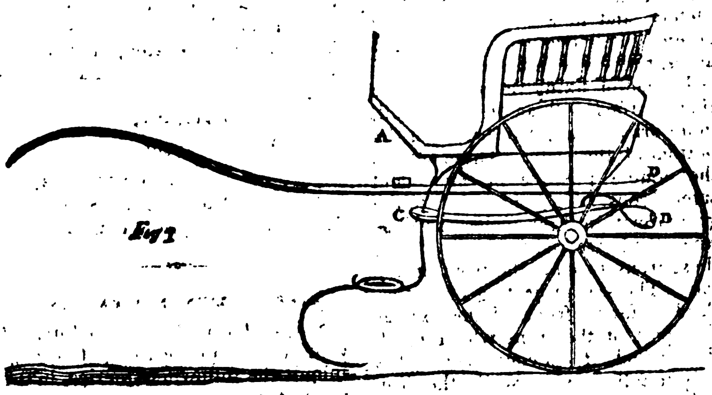


Fig. 1

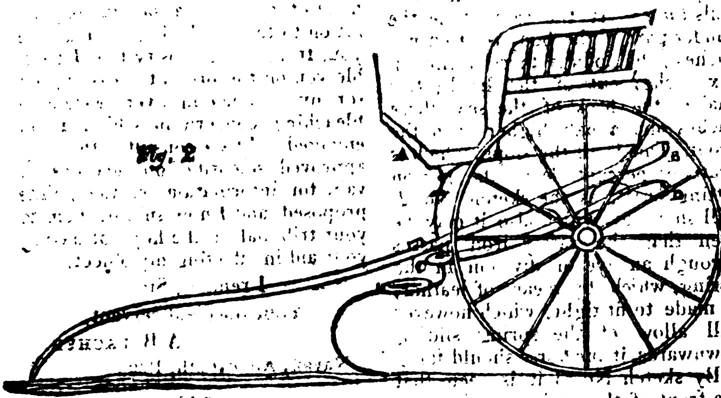


Fig. 2

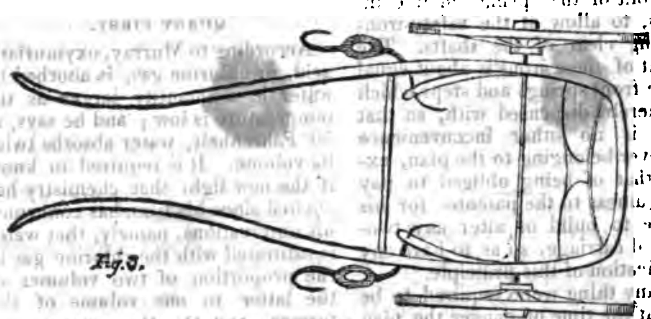


Fig. 3

SIR, — In the 98th Number of your excellent work (Inquiry No. 135), your Correspondent, "R.," asks if it is possible to construct a Safety-Gig, Stanhope or Tilbury, or any other two-wheeled carriage, the body of which should always be in its proper position, even when the

horse and shafts are on the ground? In reply to "R." I beg to say, the very thing he requires is effected, by the patent which I have taken out for that purpose, most completely, and in a way that can be applied to all two-wheeled carriages and springs now in use, as follows:—Instead of fixing the steps to the shafts; irons, with an elegant scroll, more ornamental, proceed from the bottom of the body. These answer the double purpose of steps and safety-irons. The ends reach to the ground within three inches, so that, when the horse and shafts are down, these irons support the front of the gig. The seat projecting only one-third as far in front of the axle as that part of the irons which reach the ground, it, in consequence, has only to fall *one inch*, while the iron falls *three*. At the same time the hinder part of the body is lifted five inches; the body is thereby thrown six inches out of the level; this makes the back of the seat three inches and a half higher than the front. This is all the slope, which is scarcely perceptible to the person sitting on it, as the sketch, No. 2, will show, by which also it may be seen that the safety-iron passes through an eye or division in the spring, which, by means of leather, is made to fit tight, which however will allow of the spring sliding downwards, if the horse should fall.

By sketch No. 3 it is seen that the front of the springs incline inwards, to allow of the safety-irons keeping clear of the shafts. The weight of these irons is about equal to the front springs and steps, which are thereby dispensed with, so that there is no other inconvenience whatever belonging to the plan, except that of being obliged to pay four guineas to the patentee for his licence to build or alter any two-wheeled carriage, so as to have any modification of this principle.

If any thing were required to be done at the time of danger the plan would be incomplete, but that is not the case. The amazing number of persons who are constantly losing their lives by the horse merely stumbling or tripping, will doubtless induce thinking persons to adopt this plan; and as it has no singularity of appearance, nothing to be seen, except on close inspection, when a scroll iron, about the thickness of the little finger, is discovered under the step, and which rather confers elegance than otherwise.

I am, Sir,
Your obedient servant,
H. MATTHEWS,
Patentee of the Safe Coach.
No. 9, Punderson-place, Bethnal-green.

DIFFICULTIES IN BLEACHING.

SIR,—Through the medium of your useful publication, I beg to submit the following Queries, in the hope of receiving a satisfactory solution to them. It is not, I assure you, from idle curiosity that I trouble you on the present occasion, but for my guidance in a very extensive bleaching concern in which I am engaged. I have consulted the most approved scientific publications in vain for information on the points proposed, and I now submit them to your tribunal, in the hope of having your aid in effecting my object.

I remain, Sir,
Your obedient servant,
A BLEACHER.
Navan, August 5th, 1825.

QUERY FIRST.

—According to Murray, oxymuriatic acid, or chlorine gas, is aborbed by water in a quantity larger as the temperature is low; and he says, at 50° Fahrenheit, water absorbs twice its volume. It is required to know if the new light that chemistry has elicited since his time has confirmed his observations, namely, that water is saturated with the chlorine gas in the proportion of two volumes of the latter to one volume of the former; and that the water's capacity for receiving the greatest proportion of chlorine gas, is at the temperature of 50° Fahrenheit; or if subsequent experiments have led to different conclusions?

QUERY SECOND.

Does the steam in an iron boiler oxidize its surface, and form an oxide of iron, which salt escapes with the steam; and when applied to the purposes of washing, is this the cause that the cloth is discoloured?

QUERY THIRD.

On what principle is it that the bleachers, in the manufacture of their bleaching-liquor, and previous to impregnating the water with the chlorine gas, mix a small quantity of lime with it (about two gallons of lime to 1000 gallons of water)? They say it is to make the gas mix better with the water, and this, by experience, is found to be the case. The theory and explanation of its agency, and the consequent chemical changes, are requested.

QUERY FOURTH.

A considerable variance exists among the most eminent chemists with respect to the proportions of the several materials that are used in the formation of chlorine or oxymuriatic acid gas.

	Mur. Soda.	*Ox. Mang.*	*Water.*	*Sul. Acid.*
According to Murray....	4 lbs......	1 lb.......	2 lbs.......	3 lbs.
Morveau ..	10 parts....	2 parts ...	4 parts	6 parts.
Vauquelin ..	4 parts	1 part.....	2 parts	3 parts.

Sir Humphry Davy and Mr. Ure's proportions are different from all these. Probably some of your intelligent Correspondents, or the new Chemical Society, might throw some light on this obscure subject, and fix the determinate proportions to be used in procuring the chlorine gas—the theory of the chemical action that takes place during its disengagement, and the new combinations that are formed? The theory of chlorine is, most probably, still in its infancy.

MECHANICS' INSTITUTIONS.

We extract the following letter from the Plymouth and Devonport Weekly Journal, on account of some very sensible observations which it contains respecting the best course of instruction to be pursued in Mechanics' Institutions, and which we think well deserving the attention of all concerned in the promotion or management of these excellent establishments. The writer of it is, we understand, George Harvey, Esq. F.R.S., to whom Plymouth and the neighbouring town of Devonport are, in a great measure, indebted for the establishment of their flourishing Mechanics' Institutions.

To the Editor of the Plymouth and Devonport Weekly Journal.

SIR,—The letter contained in your Paper of Thursday last, on the subject of the future instruction of the Operatives is, perhaps, one of the most important that has yet appeared on the subject, since it goes at once to the root of the matter, by plainly telling us that the Members of the Mechanics' Institute, established in these towns, want not speculative theories and showy experiments in natural philosophy to be brought before them, but such wholesome *practical* information as will at once apply to their trades and occupations, and at the same time encourage habits of reflection and thought. Now and then, it is true, an occasional discourse on astronomy and chemistry may help to diversify, but the principal feature of every course of lectures should be *practical information.* This is what the operatives understand by a Mechanics' Institute, not only in this place, but in London, in Glasgow, and in every other town in which the measure has been attempted; and I feel persuaded that the peculiar objects for which these institutions were designed, never will be accomplished unless the diffusion of *solid practical information* be made the basis of each course of instruction. Our workmen do not require to be

taught, at least for the present, the nature of chemical affinity, or the laws of electrical action. Lectures like these may amuse for a season, but, in the end, the operatives will ask, what have these things to do with constructive carpentry, with the diagonal braces of Sir Robert Seppings, or the forging of iron? We want, they will say, practical dissertations on the business and pursuits of active life, delivered in a plain and familiar way—in fact, in "our own way," in our common and familiar tongue; we want no hard names—no Latin or Greek—none of the *pop-guns* and *toys of science*—no phantasmagoriæ or magic lanterns, but the honest, homebred, practical truths of knowledge, brought down to our apprehensions by the clearest, plainest, and most convincing means. A course of lectures of this kind, sprinkled here and there with a few of the leading truths of astronomy, chemistry, and of some of the more elementary doctrines of political economy, would meet precisely the views of the *genuine* founders of Mechanics' Institutions. On the latter science, in particular, both masters and workmen require to be much better informed than they are known to be at present, particularly on that part which relates to the wages of labour. At present the masters and journeymen are perpetually opposing each others interests. The journeymen combine against the masters, and the masters against the journeymen; and that man would be rendering a most important service to his country, who, in a short compass, and in a cheap and popular form, would unfold to the operative classes of the community some of the leading doctrines of wages and labour.

Your intelligent Correspondent has very properly adverted to the fact, that the greater part of the operatives of Plymouth are connected with house-building; and I will take upon me to say that, in few towns, is there so lamentable a deficiency, both in masters and workmen, as exists in this place, with respect to the most essential principles of the art. How few among our masons have any knowledge of the properties of an arch, or any notion of estimating the pressure and strain it is subject to! How few of our carpenters possess the requisite knowledge for fixing the dimensions of a beam of any kind, if the circumstances under which the timber is to be placed differ from the ordinary course of their experience! How often have I seen whole ranks of workmen stand amazed when they have been required to state the dimensions of a timber destined to bear a given load! I mention these circumstances, to inform those who have undertaken to be the Directors of Mechanics' Institutions, what is expected at their hands, what the operatives will demand from them, if their subscriptions are not so applied as to accomplish the great purposes for which those Institutions were designed.

Institutions for the instruction of Mechanics form the most remarkable class of societies ever proposed to the consideration of man; and I do not remember if even Lord Bacon, in his magnificent description of Solomon's house (an essay which led to the formation of the Royal Society), at all attempts to provide for the instruction of the working classes, at least in the way the true and genuine supporters of Mechanics' Institutes now contemplate. And of the multitude now so happily in favour of the diffusion of elementary knowledge among the operatives in different parts of the kingdom, how few have ever thought of the proper means by which these great ends are to be accomplished! Some men patronise Mechanics' Institutions for one reason, and some for another—some for the love of a little fleeting popularity, others for the love of power—some that they may occupy the chief places in the synagogue, and be an object of amazement and wonder to the yet uneducated mechanic; but some, it is to be hoped, for the higher and nobler purpose of doing good, of benefiting their fellow-men by their exertions, and to prepare, for future generations, a rich harvest of happiness and joy. Of these several classes each will meet with its reward, for there is surely an all-seeing and ever-watchful eye keenly surveying the troubled surface of the moral and intellectual waters, watching their rising volumes, and the operations of that swell which is slowly covering the waste of sands behind, and, at the same time, producing new currents in the deeper flood.

The author of the letter here adverted to has likewise alluded to the class of persons from whom the mechanics are likely to derive the most advantage; and here, too, I cordially agree with him in opinion, that a man familiar with their practical habits and thoughts is likely to prove the most useful lecturer. Men may, indeed, be profoundly versed in the mysteries of

analysis, and the most complicated relations of definite proportions, and make but sorry instructors of a mechanics' class. Men of transcendent attainments can but rarely bend their exalted intellects to the wants and conceptions of the unlearned. The truths which present insuperable obstacles to lesser minds, are perceived with the rapidity of intuition by them. They bound from one fact to another with the rapidity of light, and in a few hours comprehend that which ordinary minds can never surmount. And thus it may happen, that a man whose mind is accustomed to reel, as it were, amidst the highest flights of philosophic fancy, may find the mighties of this conceptions fall lifeless at the feet of the mechanic. The difficulty, therefore, is to suit the lecture to the peculiar habits and wants of the persons the instruction is intended for; and my only object in offering these remarks, is to recommend to those who may hereafter become the instructors of the operatives, not only in this town, but wherever a Mechanics' Institution may be formed (and I trust every village in the kingdom will at least possess, in a short time, a Mechanics' Library), to adapt the lectures, as much as possible, to the habits and comprehension of those for whom they are intended—to couch them in language entirely plain and unadorned—but, above all, to select subjects in which the operatives may be likely to feel an interest and pleasure. This course I have shown is a difficult one; but it is an object which can be accomplished, if the guidance of those praiseworthy Institutions be undertaken by those who have their interest truly at heart, and not usurped by men of narrow and grovelling minds.

Finally, I would remark, in confirmation of what I have advanced, that it is to the strict observance of these principles that the Mechanics' Magazine owes its unparalleled circulation among the working classes. The papers contained in this most useful publication have, in general, been so truly practical and elementary, and the language in which they have been delivered so evident, plain, and familiar, that not only the workmen have been highly interested with its contents, but also many of the higher classes. But if the editor of this cheap publication had consulted fame rather than utility, by seeking for dissertations and essays from the learned—had he invited Wollaston, and Herschel, and Buckland, to adorn its pages, the work would most unquestionably have failed in its object, even had it been rendered at its present convenient price. There is a language and a mode of thought peculiar both to the learned and the unlearned. The terms that were necessary to Newton, in the pursuit of his profound speculations, were for a time inexplicable even to those who had advanced something beyond the borders of philosophical inquiry. Nor is any fault to be attributed to the philosopher on this account, since the obscurity in which new discoveries *seem* for a time to be involved, is a necessary concomitant of human improvement; and hence it is, that while science is perpetually enlarging its boundaries, it at the same time tends to simplicity and concentration; and that the investigations which crowned the highest efforts of Archimedes, can now be comprehended by fresh men at College; and hence also it is that the economists have indulged in their magnificent speculations respecting the ultimate destiny of man—speculations so heart-cheering and delightful, and so conducive to the comfort of those who entertain them, that even, although they were founded in delusion, "a wise man," says Dugald Stewart, "would be disposed to cherish them."

COMMON SENSE.

Plymouth, June 27th, 1825.

DEFECTS OF OPTICAL INSTRUMENTS.

SIR,—Some time ago there appeared in the Mechanics' Magazine (p. 101), an inquiry for a method of removing the prismatic colours from the appearance of the planet Venus through a telescope.

Dr. Smith, in his Optics, vol. I., p. 145, recommends to darken the eye-glass with the smoke of a candle; and in vol. II., p. 417, he mentions, that when Venus was very near the sun, "the splendour of the atmosphere took off so much from the excessive lustre of Venus, as to render her appearance better defined and freer from colours than at any other time and place; and that the eye-glass of the telescope need not then be smoked." Few persons would be willing to smoke the eye-glass of a valuable tele-

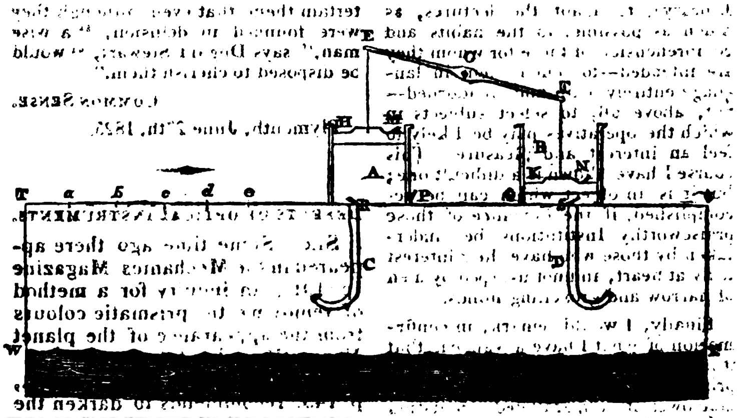
scope, but the same purpose may perhaps be answered by interposing a piece of clear coloured glass, such as the screens of quadrants and sextants are made of. Some telescopes are unfit for astronomical purposes from the imperfections of the object-glass. Veins or streaks in the object-glass may be thus discovered:—Let the glass (detached from the telescope) be fixed or held up at about the height of the eye, at such a distance as to cause distant objects to appear inverted; then keeping the eye fixed upon some point of one of the objects seen through the glass, advance very gradually towards the glass, until that object appears confused, and spread all over the surface of the glass. If the head be then gently inclined to either side, every streak or vein in the glass will be very apparent.

To discover the imperfections of a concave mirror, let it be fixed or held very near the eye; then keeping the image of the eye seen in the mirror near the centre of it, recede from the mirror until the image of the eye appears spread all over the surface of the mirror; then, by a gentle motion of the head towards either hand, the streaks and veins of the glass will be very apparent.

The imperfections of the eye-glass of a telescope, may be seen by covering the object-glass with a thick card, in which a small hole is perforated, and then looking through the telescope. These last, however, I believe, are of far less consequence than those in the object-glass.

I am, Sir,
Your obedient servant,
FOCUS.

AIR AND WATER ENGINE.



SIR,—At page 425, vol. iii. of your useful publication, there is an account of an Air and Water Engine (by Mr. Tonkin), to which I am desirous of drawing the attention of some of your ingenious readers. In my opinion, the idea of procuring a vacuum by means of water, as is there suggested and pointed out, is a valuable one, and worthy some consideration. Being busily engaged, I have little time for making experiments, and I am but a very indifferent mathematician; but underneath you have the crude emanations of a mind naturally indolent, exercised on the properties of an engine on this principle.

Description.

Let the cistern exhibited in the drawing be well supplied with water, and connected with the cy-

linders, A and B, and communicate with them by the valves P and Q. Suppose, also, the pipes C and D (each 36 feet long) connected to A and B, and communicating by the valves R and S; H and K are pistons, having the valves M and N in them, working perfectly air-tight in A and B, and giving motion to the beam, ECF (about the centre, G), and such machinery as may be connected to it.

To set this engine to work, fill the pipes, C and D, with water, and put down the valves R and S, and a column of water, nearly 34 feet high, will be retained in each of them. Next open the valve P, and the water rushing out of the cistern, L, into the cylinder, A, expels the air in it through the valve M, and fills it. Now, shut P, and open the valve R, and the water in A will descend through the pipe C, and leave a vacuum under the piston H, which piston will descend by the atmospheric pressure, and raise the piston R.

The descent of the piston, K, is effected in a similar manner, and thus a reciprocating motion is given to the beam, EGF, similar to that in the improved engine of Boulton and Watt.

Suppose T*abcde*RSV a line drawn to touch the bottom of the cylinders; WX, a river, or, it may be, a pond or cistern, whose surface is 37 feet below TV. Let us imagine a steam-engine erected at *a*, of four-horse power, for the purpose of pumping water up from this river or pond, to supply an air and water engine at *b*. I will suppose it capable of pumping sufficient for an eight-horse power at *b*, and it is obvious that, by employing a four-horse power out of eight-horse power air and water engines, erected at *bcde*, &c. in pumping we shall have an effective power of four horses at the points *bcde*, &c. for any other purpose. If a greater power were wanted at any point, say *c*, use the engines at *abc* and *d*, entirely for pumping, and (per our supposition) we shall have a power equal to 64 horses at *e*. So far with conjectures. There are many ingenious mathematicians among your readers and correspondents; I should be obliged if some one of them would answer the following questions:—

Admitting the pressure of the atmosphere to be equal to that of the steam used in Boulton and Watt's engines, it is required to find what power (horses) will pump the quantity of water, *q* (42 feet high), necessary to keep an air and water engine similar to the above constantly at work, when the diameters of the cylinders, A and B, are each *a* (24 inches), the length of the stroke *b* (60 inches), and number of strokes of the piston of each cylinder, *c* (22), from top to bottom (or the distance each piston passes over be 220 feet per minute).

It is also required to find the diameters (*d* and *e*) of the circular holes covered by the valves RSPQ, necessary to fill and evacuate the cylinders, supposing the cistern, L, always to be filled with water to a level with the bottom of each piston, when at its highest point in the cylinder.

If some of your readers among the operative mechanics would point out a mode by which the valves might be made self-acting, as also the mode of *governing* the engine, they would confer additional obligations.

I am, Sir,

Yours respectfully,

A MEMBER OF THE BOLTON MECHANICS' INSTITUTE.

Bolton, 3d July, 1825.

STANDARD MEASURE.

Caroline has seen Emilla's proposition for a Standard Measure, in No. 103 of the Mechanics' Magazine, and requests the favour of you, Mr. Editor, to tell her, that, admitting the sun would mark the same length of line in one hour, without any variation throughout the year, there would still require a *conventional* agreement on the distance of the aperture, through which his light is proposed to pass, from the surface

on which he would mark his line; it would, therefore, be an *artificial* standard, and not a *natural one*, as appears to be the desideratum, and a *similarly founded* proposal has been argued down in your former Numbers. The plan of 'C.H.' although conventional, seems nearer to nature than Emilla's. It was this:—To take six feet for the medium height of a man, by which the *fathom* would be found; half his height, the *yard;* the length of his foot, being *properly* one-sixth part of his height, would be our present *foot measure*.

August 13th, 1825.

ANSWER TO INQUIRY.

NO. 134.—VARNISHING STUCCO IMAGES.

Sir,—In answer to Aurum's inquiry in the 98th Number of your Magazine, concerning the varnishing of Stucco Images, I send you the following easy method:—

Rub the image over with a piece of white wax, after which it may be varnished with any white varnish; for instance, shellac dissolved in spirits of wine.

ANOTHER METHOD.

After the image has been well cleaned, it is to be brushed all over with whiting and water, and, when quite dry, brushed over with fine parchment glue.

I am, Sir,
Yours respectfully,
W. Tatner.

FURTHER EXPLANATION DESIRED.

Sir,—I shall be obliged to Dr. Johns if he will inform me on the following points as to the composition of a varnish for stucco images. He has merely stated what the ingredients are, without giving any information as to the proportion which each must bear to the other in the mixing of them, &c. &c. I wish to know whether the soap is to be Windsor, mottled, or yellow? and also whether the soap, wax, and water, are to be boiled together, or only left to dissolve in hot water? It is also important to know the proportions in which they are to be mixed? It is true Dr. Johns states he had not ascertained them exactly, but still he might communicate the proportions which he has found to answer his own purpose, which will, no doubt, answer mine as well. How the varnish is to be applied is another important point in this question.

I remain, Sir,
Your obedient servant,
Aurum.

NOTICES TO CORRESPONDENTS.

The Anecdote communicated by "Aurum," respecting the trick of the Glasgow Publishers, exposed in our last, is very piquant; but we had rather drop the subject. "A writer in the Glasgow Mechanics' Magazine" trusts, that we do not suppose "the Committee of Engineers, who edit that work, have any concern in taking the mean advantage" complained of. Not knowing who the members of that Committee are, we cannot judge what they are capable of doing; we only know, that every monthly part of the work they edit contains, among the recommendatory notices on its envelope, what they must, one and all, be perfectly aware, is a fraud upon us, and a gross imposition on public credulity.

A. V. wishes "a direction to the best place for procuring iron frames for melon beds."

"Turnscrew" expresses his "disappointment at not finding a farther communication in our recent Numbers from Mr. Monnom, on the subject of Screw-cutting. He trusts that Mr. M. will oblige our readers with the fulfilment of his promise, and, at the same time, explain more clearly his contrivance for Screw-cutting, described p. 166, vol. iv. He wishes us to ask Mr. M., if his plan is applicable to cutting screws in wood and

ivory, as well as metal, and to female screws?"

Mechanicus "will make an appropriate acknowledgment to any person who will inform him, by letter, if it is possible to make a bottle luminous, either corked tight or uncorked, and, if possible, how long it will remain so?" The letters may be addressed to the care of our publishers.

A Correspondent at Bath would be obliged to any of our readers for "the Plan of an Economical Grinding Machine for Razors, convertible into a Turning Lathe."

A "Tipton Brewer," referring to Mr. R. W. Dickinson's reply to X. X. (p. 123, vol. IV.), where he politely invites X. X., or any other person, to come and inspect a considerable improvement in his cleansing apparatus, remarks, that "not having any business in London, and residing at a distance, he cannot avail himself of the invitation." He trusts, therefore, that, for the benefit of all who are situated as he is, Mr. Dickinson will, through the medium of our pages, describe that improvement. Our Correspondent has adopted the plan, and highly approves of it; but when he "cleanses earlier than the scientific brewer lays down his rule, he finds the cleansing cap of the dimensions given not sufficiently large to hold the yeast working out."

A Constant Reader asks, if "any of our Correspondents can put him into the way of boring a brass cylinder, about two inches and a half in diameter, perfectly true; and also to construct the most suitable Valve for an Air Pump? The common bladder-valve cannot be used in all cases, because it is not flush with the surface it is fixed upon."

A Correspondent at Barnard's Heath says, that if "the person who signs J. to a communication respecting the Management of Bees (Number 98), will allow him the pleasure of a sight of his Hives, he will willingly go fifty miles for the purpose."

Tyro requests we will direct him to "a good book on Logic, and to another on Stenography." We do not know of any book on the former subject which treats of the art of reasoning in as practical a manner as we should like to see it taught; but, for the present, Watts' may be considered the best. The art of Stenography, according to the latest improvements, will be sooner acquired by Mr. Harding's little treatise than by any we have ever met with.

The account of the "Origin and Establishment of the Alnwick Scientific and Mechanical Institution" in our next.

T. H. B. had better apply to the first of the Societies he mentions.

P. L. M. desires to be informed "which is the best work on Fluxions, for a person to study, who has not the advantage of a teacher, and which work best shows the practical application of Fluxions?"

"Can the date of Old Silver be ascertained by its official Stamp?"—*A Constant Reader.*

Communications received from—R. W.—An Inquirer—Mr. Dowden—Mr. Lewthwaite—W. G.—R. Farley—E. S. T.—Sir J. Senhouse—A Bleacher—Aurum—Mr. Grimes—G. S. D.—M. P. M.—The Tanner—A Constant Reader—Z.—Dixon Vallance—R. B. B.—W. Bell—W. Tatner—Wm. Lake—An Old Toper—A.—W. J——D (Warrington)—A Man in the Moors.

ERRATA.

P. 271, col. 1.—For Mr. *J.* H. Bell, *read*, Mr. *T.* H. Bell.

*** *Advertisements for the Covers of our Monthly Parts must be sent in to our Publishers before the 20th day of each Month.*

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 105.] SATURDAY, AUGUST 27, 1825. [Price 3d.

A MACHINE TO LOWER COFFINS.

Fig 1

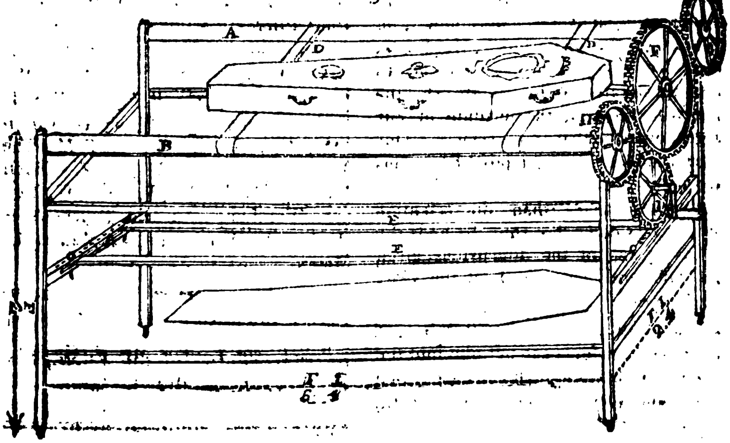
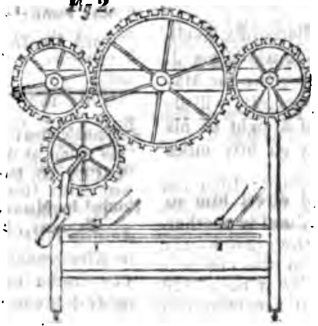


Fig 2



A MACHINE TO LOWER COFFINS.

SIR,—Having called the other day at a friend's house, he kindly put into my hands one of your useful Magazines. On perusing it I saw an inquiry (page 396, vol. II.) for the invention of a Crane to lower a Coffin into the Grave, and, after some consideration, I thought of the following plan for that purpose.

Description of the Drawing.

Let a frame (fig. 1), about six feet four inches long, two feet four inches wide, and two feet high, be constructed of inch and a half yellow deal, so as to be portable.

Suppose AB to be two rollers, three inches diameter.

DD, the webbing.

EE, two friction-rollers, made to slide in a groove, fixed with a pin in the rail, to keep the webbing from the edge of the grave as the coffin is lowered down.

F, a wheel, one foot ten inches diameter.

G, a nut, eight inches diameter, on the end of the roller, A.

H, a nut, eight inches diameter, on the roller, B.

I, a nut, with a handle running in the great wheel, and turning the nut on the roller, B.

The three nuts must be of equal size, and equal in number of teeth, about an inch pitch.

On the roller, B, let there be three studs for each webbing, to take out the webbing when the coffin is lowered down; the webbing having three holes or loops at the end, to fasten it to the roller on the studs. A rotchet-wheel to be put on roller B, at the end next the nut.

Fig. 2 represents an end view of the machine. The mode of using it will be as follows:—

Place it over the grave; turn the handle of the nut, I, to tighten the webbing; then adjust the two friction-rollers to the edge of the grave by the pins in the rail. When the coffin is brought to the grave, let it be placed on the webbing, when a person has only to take hold of the handle and lift out the rotchet, and the coffin will be lowered slowly and steadily.

I am, Sir,
Yours respectfully,

Petworth. E. G.

ORIGIN AND ESTABLISHMENT OF THE ALNWICK SCIENTIFIC AND MECHANICAL INSTITUTION.

MR. EDITOR,—As there is no record of this transaction beyond the fugitive Tract by Mr. T. H. Bell, which originated it, and the printed rules of the Society, I shall trouble you with a short detail.—This Tract, addressed, "To the Inhabitants of Alnwick who feel an interest in the Establisment of Literary and Scientific Institutions," setting forth their advantages, and the facility with which one might be established in Alnwick, was distributed in the town and neighbourhood on Saturday, September 16, 1824. In the termination of the address Mr. Bell observed—"Should this suggestion be disregarded *now*, I trust it will ultimately resemble those germs whose vegetative power is uninjured by long inhumation, and which await but an exposure to a favourable atmosphere." Accordingly, the germination and fructification were not far distant; for, on the evening of the 1st of December, a public meeting was held in the Town Hall, pursuant to resolutions adopted at a previous meeting of friends to the Institution, in the school-room of Mr. John Pears, A. M., to whose exertions, those of Mr. William Davison, chemist, and Mr. M. T. Johnson, the greatest praise is due.

This meeting was of the most flattering description, numerous and respectable; it exhibited the appearance of an election, and augured the most complete success. The chair was taken by Mr. James Russell, senior, a mechanic of fifty years standing, whose silver locks and serenity of aspect added grace to the manner in which he opened the business of

the meeting. He was supported by Mr. Henry Hunter, Mr. Michael Gardner, Mr. John Nesbitt, and other master-mechanics. His Grace the Duke of Northumberland had been previously solicited, and had agreed, to become Patron of the Institution, and Earl Grey its President; Lord Prudhoe and thirteen other gentlemen Vice-Presidents. A Committee of eighteen persons and two Secretaries was then appointed. During the moving of the necessary rules some of the movers expressed their sentiments on the occasion in very appropriate speeches; Mr. H. Hunter, Mr. M. T. Johnson, and Mr. Head. Mr. James Ferguson, master of the Borough-School, on rising, observed—"In consideration of the situation I hold in the Society about to be established, I may be allowed to say, that the promoters of the Institution, viewing with interest the respectability of the Mechanics of Alnwick, consider it an object of the highest importance to establish a Library, consisting entirely of books on scientific subjects, for the purpose of disseminating such knowledge and information as may be most useful to them in their respective professions, and which, if made a proper use of, will, I doubt not, be productive of incalculable benefits to them. But, without a firm determination to pursue the cultivation of the mind, little scientific knowledge can be acquired; for nothing valuable in science can be accomplished without labour, and nothing is denied to perseverance and application. The seeds of knowledge are sown in every soil, but it is by proper culture alone that they are cherished and brought to maturity. A few years of early and assiduous application never fail to procure us the rewards of our industry; and who, that knows the pleasures and advantages that the sciences afford, would think his time misspent, or his labours useless? Riches and honours are the gifts of fortune, casually bestowed or hereditarily received, and are frequently abused by their possessors; but the superiority of wisdom and knowledge is a pre-eminence of merit which originates with the man, and is the noblest of all distinctions. By steady application you will easily surmount all obstacles, the intricacies of science will flee your approach, and the certainty of the conquest will be ensured from a determination to conquer. By an early attachment to scientific studies you will acquire a habit of reasoning, and an elevation of thought, which fixes the mind, and prepares it for every great and noble undertaking. It affords me great pleasure to see so great an assemblage of Mechanics on such an occasion, as it proves the sympathy of the meeting with those who have promoted the Institution. I conclude with expressing my most fervent wishes for the prosperity of this Society."

On rising to move the twelfth rule, Mr. Thomas Henry Bell observed—"So much has been written and said to prove the utility of these Institutions, that it may be deemed a waste of words, and an unnecessary consumption of your time, to attempt still farther to prove a truth of which all are convinced. If my remarks should, therefore, appear more rhetorical than reasoning, I trust I shall have your excuse. It is a most gratifying reflection, that in England, where Institutions are so rapidly forming, the most enlarged idea of establishing associations for the advancement of science originated. Lord Verulam recommended scientific persons in different countries to associate and communicate with each other, and to give to the world an account of their researches and discoveries. On this suggestion the Royal Society of London was formed, which was succeeded by the Royal Academy of Sciences at Paris. The spirit of discovery and improvement excited by these and succeeding institutions, has proved their vast utility. By their operation uninteresting speculations have been superseded by useful inquiries,

and ingenious, but erroneous hypotheses have been obliged to yield to demonstrative experiment. Such expectations it would be the height of absurdity to entertain of the present or any similar Institution. The Alnwick Mechanics' Society, and similar cotemporary societies of Britain, can only be considered as so many canals, which, like those of the Nile, are to be filled up by the overflowings of the great river of knowledge. Such institutions are only an enlarged plan of education, and, properly conducted and extended, may at last induce jarring nations, not only to profess, but to act as members of one great family, and thus diffuse the sentiment of benevolence wherever there are hearts to feel, or hands to grasp.

"There are many things favourable to such an undertaking in Alnwick, not the least of which is the moral character of that part of the population for whose use this Institution is chiefly intended. Some of them, perhaps, when a little exhilarated with their native beverage, may profess to 'know all qualities;' but, generally, they are grave, grateful, and unassuming. It certainly cannot be considered any objection that this has not had its origin with mechanics alone. I trust we have all, more or less remotely, had an useful origin. I am not a mechanic, and there are many individuals present better qualified to engage in such an undertaking; but I consider myself in some degree excusable, since I had a mechanical origin. I draw my existence from men whose hard hands gained them bread, and whose honesty gained them esteem. However, the object of this meeting 'comes not in a questionable shape;' it bears the stamp of utility, and will encircle in its embrace the artist who applies his microscopic eye to the wheels of time, the smith with his dusky brow, and the strong labourer, who, with his iron implements, rends the rocks, and prepares them for the chisel of the mason. Its utility will be farther obvious when we consider, what I observed in the printed address, that 'where the niggard hand of Fortune has denied, to individuals possessed of superior talents, the instruction necessary for their development, the establishment of scientific institutions must nearly balance the misfortune.' When young persons come forward under such circumstances, they ought to be specially favoured. They are the hopes of their country, and may be properly considered as the children of the public. But in nothing is an Institution more desirable than in this: Uniting men of different persuasions in one common object, a friendly spirit will be produced, and that repulsion, that standing aloof disposition, for which we men of Alnwick are somewhat remarkable, will be melted down in the general amenity. Occupied in the erection of such a beautiful fabric as this, how insignificant appear all those distinctions which the spirit of party fosters, and which folly so often inflates to importance! When men have got matters of demonstration to engage them, they will be less prone, like the Athenians of old, to spend their time in quest of idle news;—visits for the purpose of sipping tea and smiling slander will probably be less frequent. In the promotion of this object an opportunity is now afforded to many individuals, not to pass through life like meteors through the air, but to stamp upon their progress the characters of utility. This is certainly a day of gratulation. Often have the cannons roared, and the bells of our ancient steeple rung, on days of common rejoicing; but this is an hour in which the deep-mouthed gun might with propriety announce to the hills and the dales of Alnwick—not that the noble Percy has deigned to visit their retirement—not that the noble Grey is posting down to the groves of Howick—but that the Genius of Science has arrived amongst us, to lead,

> Up to 'the Solar walk or Milky-way,'
> Those whom their narrow fate forbade to stray!

To pursue knowledge is the character of the age; and under the auspices of Britain (for what nation can compete with her in the cornucopia of her arts and manufactures—in the altitude of her moral name?)—under the auspices of Britain, who has cast over the nations the mantle of her munificence, the power of the Press is going into full operation, and will ultimately be hailed as a blessing where it was once dreaded as a curse. The vessels of Britain, which are to be found upon every sea, and before every breeze, may, in their courses, be considered as so many cords of affiliation which bind together the remotest regions —uniting the savage to the civilized, and the slave to the free. Such is the probability that, unless some catastrophe occur to rock the mountains and overwhelm the nations, the earth, in her course, will shortly exhibit to the luminaries of heaven enlightened people only, whose sole wars will be with the monsters of the deep and of the forest—whose only rivalry will be that of the arts.

"Poets have told us of the *golden age*, of the *age of iron*, and the *silver age*; but we are about to arrive at the age of Science and Philanthropy—at the period when the hand of man shall no longer raise to his shoulder the death-scattering tube of war—when the spear shall bend into a pruning hook, and the falchion end in a plough-share. In the contemplation of that period, the friend of man forgets his individual struggles, his incidental difficulties, and becomes, by anticipation, the associate of those fortunate beings whom succeeding ages shall bless."

The effect produced by this address was striking, and the meeting separated shortly after. The Society consists of upwards of eighty members. A library of choice scientific works is forming, and some gentlemen have agreed to lecture during the ensuing winter, so that the Institution bids fair to be of permanent utility.

CRITO.

CORKED BOTTLES SUNK IN THE OCEAN.

SIR,—In Number 80 of your most valuable work, "A Constant Reader" requests a *minute* description of all the circumstances attending the sinking of a well-corked Bottle a considerable depth in the Ocean, and I find, in Number 82, several answers to his letter, to which I beg to add mine, if you think the insertion likely to be of use to him.

About two years ago, on the homeward voyage from the East Indies, some friends of mine agreed to make some experiments, at my suggestion. One or two bottles were procured, and being corked with as sound a cork as could be got, and well sealed, were let down about seventy or eighty fathoms. On being drawn up, after about ten minutes, the cork of one appeared to be forced into the bottle, which was filled with water in a state of effervescence or boiling; the others were broken, but by what means we could not, of course, tell. The day, however, being remarkably fine, not a breath of air stirring, and, of course, highly favourable for such experiments, the following was tried:—From a great many bottles, one was selected, the mouth of which appeared to be as round and smooth as possible, into which was put a ground glass stopper, also selected from many, which fitted it as exactly as possible, and which, from its make, could not be forced in. This stopper was farther secured by a strong cord passed over it, to prevent its getting loose, thereby letting water in. Some common wax (candle) was then smeared round it, and over it four pieces of good bladder were tied. This was subsequently immersed in melting sealing-wax, so as completely to cover the bladder.

The bottle, thus prepared, was fastened, with the neck upwards, to a line (with three deep sea leads attached to it, to make it sink as fast and as perpendicularly as possible from the ship), in a sort of

net-work made on purpose, with the meshes rather open, but still sufficiently close to prevent losing any of the pieces, should the bottle be broken. It was then put overboard, and 200 fathoms of line let out; but allowing a little for the drift of the ship, the bottle could not, I should think, at any time, have been more than about 150 or 160 fathoms from the suface.

In five minutes from the time the last fathom was let out, we commenced hauling in, and the result was very different from any I had ever seen or heard of.

We found that the bottom of the bottle had burst *in*, and with such force as to break two or three pieces out of the shoulder (if I may call it so). The neck was not broken off altogether, but merely two or three pieces out, and cracked all round, but kept in its place by the net-work. The bottom was evidently forced *in*, from the appearance of the fracture round the edge (which I always thought was the strongest part of the bottle), and also from our not being able to get the bottom out until the neck was broken off. From the neck to the bottom the bottle was perfectly sound, without even a crack.

I do not know that I have made myself sufficiently understood; but if not, I shall be happy to explain, as well as I am able, at any future time. In the accounts I have read of such experiments, the length of line *let out* has seldom exceeded 80 fathoms; I shall be glad, therefore, if "A Constant Reader" will favour your numerous other readers with his explanation of the cause of such a different effect, at so much greater distance.

I am, Sir,
Your sincere well-wisher,
H. S. H.

Ireland.

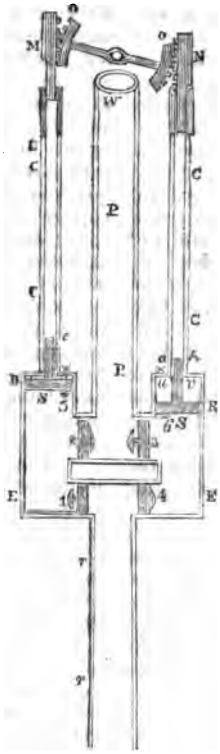
REFLECTION ON THE STUDY OF DEMONSTRATIVE SCIENCE.

MR. EDITOR,—The study of mathematical subjects, perhaps more than any other, affords a noble exercise, and invigorates the faculties of the mind. Demonstrative Science is too much neglected; and as men must be somehow engaged, they seem, almost unanimously, to have quitted the *terra firma* of certainty for the land of ideal speculation. They are captivated by folly, they are interested by subjects in which certainty can never be attained, they have left the beautiful regions of demonstration for the very *Zaara* of mind, party politics, novels, and idiotic conceits. We everywhere encounter men who stun us with their knowlege of THE USELESS, with their erudition in Reviews, and their aptitude for all ephemeral vanities: "Know thyself" would be a precept vainly addressed to such, for they frequently cannot compute the superficies of a table, much less the contents of the human head. These individuals resemble those ancients who, rushing into the heavens, wished to construct the universe before they knew how to measure it. I would remind these persons in their flight, that there is such a thing as the Earth—such a thing as Man and Laws of Nature, which they would do well to study, and forsake the creation of *intangible beings* for *sensible tangents* and *angular realities*. The scientific and mechanical institutions so generally establishing will operate beneficially, if they only excite the rising generation to study the relations of number and quantity. The great sin of this age is not pugilism and bear-baiting, but rhymes and speeches; to atone for which a century of silence would not suffice. But these institutions will shake the empire of novelty and romance, and plant society with different men.

I am, Sir,
Your obedient servant,
THOMAS HENRY BELL.

Alnwick.

GOLD MINE PUMP.



SIR,—I submit, for insertion in your pages, the plan of a Gold Mine Pump, which will supersede the necessity of cutting new shafts, to suit the windings and various elevations and declinations of the mines. I have been informed, that in the gold and silver mines in South America, the rod-pump is often rendered useless, from the want of some such contrivance.

Description.

rr Represent a pipe that enters the well, and is supplied with water by means of the pressing weight of the atmosphere; BEBE are two working barrels; PP, the stand pipe; CCCC are half-inch pipes filled with water; *oo*, the working beam, that acts on the pistons, MN, that work in the half-inch pipes; ASSa are buckets; *vv*, evacuants. If any small quantity of water issue into the evacuants, the piston-blocks, xx, force it back through the valves,5,6; the numbers 1, 2, 3, 4, represent the four valves.

Perhaps a rough calculation would be the best mode of elucidating the principle of this invention. Let us suppose the depth of the pipes, CP, to be 500 feet, the barrels, four feet, and the pipe, *rr*, 16 feet; the diameter of the above to be 20 inches, except that of the pipes CCCC, which is half an inch. The weight of the water on the buckets, *ea*, weighs 30 pounds; the pressure on the buckets, SS, is equal to 1500 pounds each; so that, at the rising of the piston, M, the

pressure of the atmosphere, 1500 pounds, will force the bucket, S*e*, up, so that the water will keep rising with the piston, M, at the same time the piston, N, will be forcing the water downwards. The water will, in consequence, force the bucket, *a*, so that the water in the barrel is forced out through the valve, 3, into the pipe, PP, and out at W. Now, it is easily to be perceived that an evacuation will be created at *v*; that afterwards the piston, N, will be raised, and the effect will be as described of M, and the effect on M as described of N, and so on alternately, so that a continual stream will flow out at W. The pressure of 1500 pounds is produced in consequence of the buckets, SS, being 20 feet from the level of the water; so that there is left five pounds on the square inch, which multiplied by 300 inches, the area of the bucket, gives 1500 pounds.

The advantage of this pump is evident; as, whatever the winding of the mines might be, the pipe of such a pump might be turned accordingly, without any obstruction to the pump, and all the expense of cutting new shafts would thus be saved.

I am, Sir,
Your humble servant,
DAVID THOMAS.

Borough.

SHAKESPEARIAN SUSPENSION BRIDGES.

We have already noticed more than once the ingenious Suspension Bridges of Coir Rope, recently introduced into India (see Mech. Mag. page 310, vol. III,); and now quote, from the *Calcutta Government Gazette*, the following account of the metamorphosis of one of these bridges, at Allypore, "into one of Sylhet cane, or ground rattans:"—

"This curious change was, we understand, effected with ease in a few hours. The result is very interesting, inasmuch as it proves the great facility and economy with which these ingenious structures can be composed and suspended.

"It appears that canes, from 100 to 225 feet in length, and from one to nearly two inches in diameter, are procurable on our north-eastern frontier, merely for the cost of the labour in collecting them together. The Governor-General's agent, Mr. Scott, when at Sylhet, sent down to Calcutta, at the request of Mr. Colin Shakespeare, a supply of canes, coiled up like rope; and of which he has constructed the present small bridge, of 130 feet span by 5 feet in width. Not only the roadway, but all the radiating guys, catenary curved swings, preventer braces, and vertical suspenders, are of cane, none exceeding one and a quarter inch in diameter, and many not three-quarters of an inch.

"The use of iron thimbles throughout the composition gives an air of symmetry and neatness, while they greatly diminish friction, and add much to the strength of the bridge, which, like its rustic predecessor, has only one iron-jointed arm in the centre.

"The appearance of the arch is singularly light, even more so than rope; and it is in reality lighter as a whole, because the bamboo cross slips, forming the roadway, are lashed at once to the canes, and thus it becomes firmer than in the rope bridge, in which the treadway is distinct, and lies over the strands.

"Eighteen canes, of 150 feet each, form the bearings. These are lashed together at each end of the bridge, and then bound round four *open hearts*, in substitution of dead eyes. Thus the *setting-up power* acts in the same way as with the rope bridge.

"There are no friction-sheaves in the standards, with the exception of one for the lowest guy, the angle being acute.

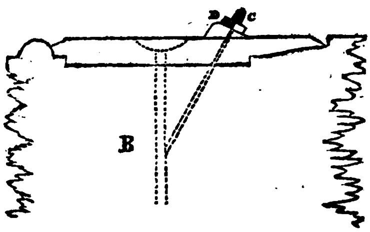
"The strength and durability of the cane is by some considered equal to that of rope, and this is a question that time will solve. Meanwhile, it is quite clear, that if the cane should only last a season or

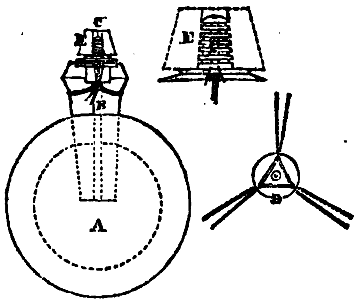
two of the rains, and it is strongest when kept moist, the advantages gained to the country abounding in that useful and cheap commodity, will be incalculable; no bridge whatever, we believe, having been attempted in that quarter up to the present time. And we may conclude, that the natives, from habit and method in working up cane, will improve both on the neatness and strength of cane bridges now to be introduced, especially as they well know, from experience, how to choose the best kind of cane, and to cut it at the proper season for the purpose intended.

"The Right Hon. the Governor-General visited the cane bridge, and his Excellency was pleased, after a minute inspection, to signify his approbation of so novel and useful a structure.

"The original experimental Berai Torrent Bridge, still lying at Allyporé under cover, was also exhibited to his Excellency, preparatory to its return to its station, for the third season of the approaching rains. It is then, we are told, the Postmaster-General's intention that it shall be accompanied by a new bridge for a torrent a few miles west of Bancoorah."

PERCUSSION CANNONS AND GRENADES.





SIR,—I beg to forward to you, for insertion in the Mechanics' Magazine, sketches of part of an Eighteen-pounder, and of a Hand-grenade and Fuse, to be ignited by Percussion Caps.

Description.

THE EIGHTEEN-POUNDER.

A, the vent-field.

B, the vent-hole, shown by ticked lines.

C, the conductor which receives the percussion-cap.

D, the vent-hole to the conductor.

N.B. If the cartridge is pierced with a priming-wire, there is not any necessity for priming. The blow must be given with a metal hammer.

THE HAND-GRENADE.

A, the grenade.

B, the fuse.

C, the conductor, fastened to the fuse.

D, the conductor, showing the under side.

If the conductor is fastened on in the manner shown in the sketch, it will fall off as soon as the fuse takes fire; if fastened with wire, it will keep on, and show but little light.

The chamber of the fuse need not be primed, as the conductor will set fire to the composition.

The outer line, E, is the size of a piece of cork, with a hole through it, which must be pressed down over the cap, and cut off well with the top of the cap, and which will secure the burr, at the bottom thereof, in the groove: this is in case the cap is wanted to be kept on, ready for the grenade to be thrown at a moment's notice.

The cork will yield to the blow when struck against metal, stone, or any other hard substance.

I am, Sir,
Your obedient servant,
WILLIAM SPENCER.
11, Ordnance-place, Chatham.

MECHANICS THE MOST IMPORTANT BRANCH OF NATURAL PHILOSOPHY.

SIR,—The extensive application, in the present day, of mechanism and of mechanic power—the valuable Institutions which have been established for the cultivation of this science, and the universal encouragement with which it meets, mark the present as a great and important era in its history, and, at the same time, prove that, in a consideration of the relative value of the several branches of Natural Philosophy, Mechanics stands the first.

The value and importance of any one of these is not to be determined by the grandeur or magnitude of the subject of which it treats, but by its applicability to the benefit, usefulness, and happiness of man, in the departments of agriculture, arts, manufactures, and commerce; the production of these is conceived to be the true test of their relative importance. If, in taking the three leading ones of astronomy, chemistry, mechanics, we were to judge of them by their grandeur and magnitude, we should, perhaps, without hesitation, pronounce astronomy to be the first, probably chemistry to be the second, and mechanics the last; but if we view them by the foregoing test, in reference to the great objects of life, we shall not only alter, but exactly reverse this order. Man is in himself, indeed, a feeble creature, in comparison with what he effects; and how little of what he performs would he be able to accomplish without mechanical aid!

To mechanics is agriculture indebted for the wheel, the various implements of husbandry, the plough, and the thrashing-machine;—manufactures, for the crane, the wheel, the screw, the wedge, and the various implements by which they are carried on; such as the pliers, the pincers, and the scissars, which are all modifications of the same principle.

In the arts and in commerce, it is only necessary to point to our palaces, cathedrals, and bridges—our ships of war, and fleets of merchantmen; and from these to descend to the diminutive instrument of the key we turn in the lock, and the bit with which we curb the steed; and we shall find that, in every gradation between these vast extremes, the importance of mechanics is never for a moment suspended. Its value to *commerce*, in reference to the *ship*, is of a most striking description; the lever, the pulley, the wheel and axle, the wedge, the inclined plane, and the screw, are immediately suggested to the mind. The ship-builder lays down the keel, fixes in the timbers, and bends the stubborn plank by the application of mechanic power. Behold the stupendous body completely constructed! But it appears immoveably fixed. What hand, or accumulation of hands, can move it? Recourse is had to the screw and the inclined plane, and the ship slides majestically down the launches into her native element. The process of putting in the masts, rigging the ship, and taking in the cargo, are all carried on by the constant application of mechanic power. The ship is now ready for sea: by means of

the pulley the mariner hoists and spreads the powerful sails; she is ready to get under weigh, but the anchor is buried deep in the bed of the river; he has recourse to the windlass or capstan, and it is weighed with ease. Surely mechanics has done enough for the ship, or is she wholly dependent upon it? The gale swells the sails—she is rapidly impelled forward. But whither is she going? Already is she in danger of some rock or shoal. Behold the pilot at the helm (a lever), whose puny arm, with a facility that is truly astonishing, directs this vast body at his will. Aided by this stupendous power,

"He steers the winged ship, and shifts the sails,
Conquers the floods, and manages the gales."

But, Sir, although this branch of natural philosophy is of so great importance, it is not to be considered as all in all. Natural philosophy is a community, of which its several branches are members, and each is essential to the whole. It reminds me of the Arabian Tale of the three brothers, enamoured of a princess, who was in a distant country: one possessed a telescope of extraordinary power; another a machine, by which he could, with the greatest velocity, transport himself to the most distant country; and the third, a certain elixir, which, if administered to the dying, would restore life. The brother who possessed the telescope was one day looking through it, and discovered the princess in the agonies of death; he instantly applied to the possessor of the extraordinary piece of mechanism, and they were all three immediately transported into the presence of the princess; the restorative was administered, and she was restored to life. Each, to obtain her hand, pleaded the importance of the art he possessed: "But for my telescope," said one, "your illness would not have been discovered." "But for the machine," said the other, "it would have been in vain that we saw your situation, for you must have expired before we could have arrived." "And both would have been perfectly useless," exclaimed the third, "unless I had possessed and administered the medicine which restored you to life." I shall not, Sir, trespass upon your valuable pages, to consider, in detail, the importance and value of astronomy and chemistry, of which there can be no doubt. I shall merely remark, that by means of the first we calculate time, the seasons, and their changes, and can steer with certainty through the pathless ocean; while, from the second, we derive the restorative and the anodyne, and a thousand useful combinations in the arts and manufactures. Nevertheless, I conceive, from what has already been shown, that it may be fairly concluded, that the power which enables man to build a ship to take him, in spite of winds and waves, into another hemisphere (there to exchange the products of agriculture, arts, and manufactures, and this to the advancement of his own happiness, comfort, and knowledge, and thereby the knowledge and civilization of the world,) that invests him with a power so gigantic, that, with it, there is scarcely a project which he can imagine, that he cannot thereby execute—is second in importance to no one of the various branches of natural philosophy. So stupendous, nay, infinite, is its principle, that Archimedes is said to have exclaimed, that if they would only find him a fulcrum on which to rest his lever, he would lift the world. The saying of that great mechanician may at least be considered as a figurative expression of the wonderful power which mechanics gives to man, and the effects which mechanics would one day produce in the world, in ages remote from that in which it was, as it were, prophetically uttered.

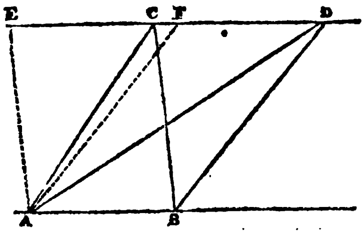
I am, Sir,
Your most obedient servant,
INDICATOR.

MECHANICAL GEOMETRY.

(*Continued from page 420, Vol.* III.)

THEOREM III.

All triangles standing on the same or equal bases, and of the same perpendicular altitude, are equal to each other; or, which amounts to the same thing, all triangles whose bases are equal, and which are drawn between the same parallel lines, are equal to each other.



Let ABC be any triangle drawn between the parallel lines AB and ED; now, if on the base, AB, we draw any other triangle, as ABD, this triangle will be equal in superficial content or area to the triangle ABC.

From the end of the base of the triangle, as A, draw AE parallel to BC, and also draw AF parallel to BD, of the triangle ABD; then we shall have two parallelograms, ABCE and ABDF, standing on the same base, AB, and between the same parallels, AB and CD; then (by Cor. 2. of the last Theorem) these parallelograms are equal to each other; but the sides of the triangles, AC and AD, divide the parallelogram into two equal and identical triangles (by Theorem VII. Part I.); and hence the triangle ABC, being half the parallelogram ABCE, it is also half the parallelogram ABDF; but the triangle ABD is half the parallelogram ABDF, therefore it is equal to the triangle ABC, which was to be shown.

Cor. 1.—Hence, to measure a triangle, if we multiply the base by the perpendicular height, we shall have double the content of the triangle; hence we deduce the Rule for measuring triangles, viz. multiply the base by the perpendicular altitude, and half the sum is the area, or superficial content; or half the perpendicular altitude multiplied by the base, or half the base multiplied by the perpendicular altitude, will give the area.

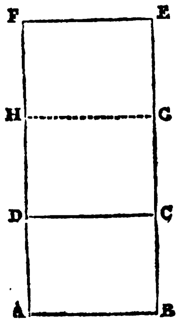
Cor. 2.—Hence, if on any given line we describe a parallelogram, and on the same base we describe a triangle, whose perpendicular height shall be equal to the width or height of the parallelogram, the triangle will be equal to half the parallelogram, or the parallelogram will be the double of the triangle.

Cor. 3.—Hence also triangles and parallelograms, on the same or equal bases, and lying between the same parallels (or of equal altitudes) are in proportion to each other as 1 to 2.

THEOREM IV.

Parallelograms which have the same base, or equal bases, but of different altitudes, are in proportion to each other as their altitudes.

Let ABCD be any parallelogram standing on the base AB, and let ABEF be another parallelogram standing on the same base; we have to show that these parallelograms are in proportion to each other as the lines BC and BE.



Let us suppose, for illustration, that BE is equal to three times BC; divide the line BE into three equal parts, as at C and G, and draw GH; then the whole parallelogram, ABEF, is divided into three parallelograms, whose sides, BC, CG, and GH, are all equal; and the other sides, AD, DC, and HF, are also equal; consequently they are all equal parallelograms: but the whole parallelogram, ABEF, contains three parallelograms, each equal to the parallelogram ABCD, by construction; consequently ABEF is equal three times ABCD, which is the same proportion that the lines BE and BC have to each other; viz. the ratio or proportion of 3 to 1, which was to be proved.

COR. 1.—Hence triangles which stand on the same base, or equal bases, are to each other in the same proportion as their perpendicular altitudes; for we have shown (Theorem III. Part 3) that triangles are the half of parallelograms, of equal bases and perpendicular altitudes, and by this Theorem we have shown that parallelograms have the same proportion; but if the whole parallelograms have this proportion, their halves (or triangles) must have the same proportion.

COR. 2.—Hence also we see, that in parallelograms of the same altitude, but of unequal bases, they are in proportion to each other as their bases; for, in the last figure, if we conceive the line AF to be the base of the parallelogram, ABEF, and AB its altitude, and ABCD another parallelogram, whose base, AD, is one-third of the base AF of the other parallelogram, and the altitude, AB, the same, it is clear, as we have only changed the lines AB for altitude, and AF for base, the same thing must hold good; viz. that we shall have this proportion between the parallelograms. As the parallelogram ABEF is to the parallelogram ABCD, so is 3 to 1, the proportion (assumed in this case) of the bases AF and AD.

COR. 3.—Hence also triangles of equal altitude, but whose bases are unequal, are in the proportion to each other as their bases, as they are the halves of parallelograms.

COR. 4.—Hence also we may conceive, that parallelograms whose bases and altitudes are unequal, are in proportion to each other as their bases and altitudes jointly; that is, in the language of mechanics, as their superficial content, or their bases, multiplied by their altitudes. To render this idea plain, we will suppose a parallelogram, whose base is 2, and altitude 3, to be compared with another, whose base is 4, and altitude 6; now, the superficial content of the former is twice 3, or 6, and the latter four times 6, or 24, that is, the ratio or proportion of the two parallelograms is as 6 to 24.

COR. 5.—Hence, again, triangles being always the halves of parallelograms, we shall have them always in proportion to their bases and altitudes jointly, when their bases and altitudes are both different.

NOTE.—The foregoing Theorems and Corollaries contain the fundamental principles of mensuration, and of which we shall, as we proceed, avail ourselves, and endeavour, by familiar examples, to illustrate their use in practical mensuration; and as these essays are not meant for the *geometrician*, but for the *workman*, we trust we shall

be pardoned for not entering into all the difficult and never yet clearly explained doctrine of proportion (at least to the general capacities of mankind), as, in the progress of this work, I think I have sufficiently shown, that the great object I have in view, is to render familiar to the working mechanic the truths that men of science have discovered, and to apply to practical utility such parts of geometry as will enable us to comprehend the reason why such and such operations produce corresponding results.

G. A. S.

(To be continued.)

THE AIR BALLOON OF THE SEVENTEENTH CENTURY.

SIR,—On consulting a copy of the curious work to which your Correspondent, Mr. Macfarlane, refers, in your last Number, I find nothing there said about the machine, of which you have given a drawing, having been used to bring the inventor and two other persons on shore from a ship at anchor. The engraving is a correct copy of the original; but the scheme is described, by its author, as a speculation on the possibility of navigating the air in a machine buoyed up by hollow globes exhausted of air. He endeavours to prove its practicability by an analogous experiment on water, and by the fact, that the surface of a sphere increases in the ratio of the square of its diameter only, whilst its capacity is as the cube of that diameter. From this he argues, that hollow spheres might be made of copper, or some other metallic substance, of sufficient bulk to ascend and descend, with any weight attached, by the alternate exhaustion and readmission of the atmospheric air. Thus the apparatus is far from being "an air balloon invented in the seventeenth century;" and it is to be feared that none of your Correspondents will be able to make it "available in cases of shipwreck upon a lee shore."

I am, Sir, yours, &c.

G. Z.

CALCULATING INTEREST.

SIR,—I have just received from my bookseller the 24th Part of the Mechanics' Magazine, and find, on perusing No. 93, that you have done me the favour to insert a trifling communication of mine on the subject of Calculating Interest; and on reading No. 95, I found this article was honoured with the notice of "G U. A.," who, very sapiently, observes, "it is any thing but useful," and it is tedious in its application." He asks whether it be easier to divide by 365 to get the answer in shillings, and then divide by 20 to bring that result into pounds, shillings, or pence (it was only now we were informed that dividing by 20 would give pence for a quotient), or to divide by $365 \times 20 = 7300$ at once? It appears that G. U. A. is not a constant reader of yours, or he would have discovered that this great improvement was promulgated to the world so long ago as March 12, 1825, in No. 81, page 388, of your valuable miscellany. He also informs us of his expectation that I shall next direct to divide by 30,416 to obtain the quotient in pence. I reply, I shall not; inasmuch as this quantity is $= \frac{365}{12}$; expressed decimally, 12)365(30,416666, *ad infinitum*, and must therefore be an imperfect divisor.

He calls me "a learned mathematician" (would I were!), and says, "I would have you believe there is something of importance in my communication, when I told it in my pompous and pedantic style." May I entreat of you to consider what has been said, and then just bestow a thought upon the following few words, descriptive of the origin of my communication?

A gentleman who had seen the article in No. 81, mentioned to me that he had been, many years ago, taught by a person conversant with the subject, that interest at five per cent. was most easily obtained by multiplying the sum by the days, and dividing by 365; in which case the quotient would be the answer in shillings. I unhesitatingly replied to this observation, that the thing was impossible; but he stated that he and many of his friends had been many years using that mode, adding 75 to the result when the rate was six.

The interest of 75 pounds for 146 days, at five per cent., is certainly 30 shillings, and $\frac{75 \times 146}{365} = 30$. This coincidence puzzled me, having just denied

the truth of the theorem. When I went home, I sat down and wrote the few observations which I sent to you; and there is not a schoolboy who would not perceive from every line of it, that my sole object was to prove the fallacy of it, and thereby prevent its use; and I flattered myself that I had not only proved that fact, but explained the causes of it: and I have no hesitation in adding, that in the hands of a person able to comprehend my analysis of it, it would be by no means an useless piece of information.

My humble intention was to be useful, and in commenting on me, G. U. A. gives us a theorem, not as a short, but as a correct method, and merely, as it is original, to amuse the curious, viz.—To find the interest of any sum for one day, divide by 12,80 and 17,500. I must confess that I should never discover the value of these divisors, did not G. U. A. favour us with the following example, which appears to me a concentration of brevity, and in which I have learned the values of the above-mentioned divisors, viz.—$\frac{1}{12}$, $\frac{1}{80}$, $\frac{1}{17,500}$; the sum of which appears to me $= \frac{1610960}{16800000} =$,0095890, expressed decimally.

EXAMPLE.

10,000*l.* for 100 days.

	1,000,000
$\frac{1}{12}$	83333
$\frac{1}{80}$	12500
$\frac{1}{17,500}$	57
	109,5890
	20
	11) 7800
	12
	9) 3600
	4
	1) 4400

We have now obtained this information, viz. the interest of 1,000,000*l.* for one day is 109*l.* 11*s.* 9¼*d.*; but we have yet to inquire at what rate per cent.? for of this trifling feature in the transaction G. U. A. has not informed us.

Now, with my usual pompous and pedantic style, allow me to analyse this little sum, which I understand as having been proposed to be worked.

The interest of 1000*l.* for one day may be stated thus, at the rate of 4 per cent.

365) 40 (00,1095890
3500
2150
3250
3300
150.

Thus we find the interest of any sum for one day, at 4 per cent., to be greater than $\frac{1}{10000}$th part of the sum, and the excess is equal to the $\frac{1}{10000}$th part of the $\frac{1}{12}$th, $\frac{1}{80}$th, and $\frac{1}{17,500}$th parts; the sum of which is $= \frac{1610960}{16800000} =$,009589 &c. &c.

We have now unravelled the whole system: when we place the decimal point four figures from the right, we produce the effect of dividing by 10000, and the figures to the left become integers, and, with the fractional parts added, exhibit the true interest. We may vary this by multiplication, for we have, in the quotient, a factor, which, if multiplied by any sum, will give the interest of it for one day, viz. 800*l.* for 100 days.

1,09589
80000 = 800 × 100

8,7671,20000
20

15) 34240
12

4) 1088

You will observe that the sum here amounts to tens of thousands; therefore the unit which was a decimal in the quotient, derived from the interest of one thousand, becomes an integer in the above, and having five decimals, we cut off five from the product,

and then cut off four figures more, as directed.

I hope the above solution will make friends of G. U. A. and

Your humble servant,
RICHARD DOWDEN.

Cork, 8th July, 1825.

INQUIRIES.

NO. 138.—DYING SILK PINK.

SIR,—I have been a constant subscriber from the commencement of your valuable work, and observing that it is common to request information on any particular subject through the medium of its columns, I should feel obliged to some of your kind readers to send me the proper process of dying silk a good pink. I have been at a great expense and trouble with experiments to no purpose. I am sure it must be well known in London, Spitalfields, &c., but in country towns it is considered a great secret. Some time ago I asked my *own brother* to inform me of the process, but he refused: judge, then, how much I shall feel obliged to any of your enlightened Correspondents who will communicate the secret to,

Your obedient servant,
M. C.

NO. 139.—REAL AND APPARENT TIME.

SIR,—Will any of your astronomical friends have the kindness to explain whether the time that, by refraction, we see the sun after he is actually set, is taken into consideration in the calculations of the tables connected with the subject in our common almanacks? For example: Looking at the setting sun any evening, say the present, 30th July, I find, by an almanack, that he sets at 44 min. past 7, and the table of "equation of time" shows that the real time must be 6 min. 3 sec. faster. Am I, therefore, to set my watch at 50 min. 3 sec. after 7, or, by deducting (about 8 min. I believe) for the refraction, only at 42 min. past 7?

An Old Subscriber,
H. M. M.

Bath.

CORRESPONDENCE.

If A. B. will favour us, confidentially, with his name, or reference to some responsible authority for the accuracy of his statements, we shall not hesitate to unmask the impostor, however "reverend," of whom he speaks. He will perceive, from the letter of a Correspondent inserted in our present Number, that the deception is, to a certain extent, already exposed.

The Communications of W. H. S.—J. L. E.—W. Shires—Mr. Moyly—D—R. W.—Mr. Lewthwaite—Discipuli—F. O. M.—F. W. C.—are intended for insertion.

G. Z.—Our arrangements on the footing alluded to are complete.

Philo-Botanicus will have an answer soon.

How does A. J. know that his new Hobby-Horse will run at the rate he describes? Has he tried it?

A Correspondent begs to refer "An Old Tanner," for full information respecting the Machine for Quick Tanning, to which he alludes, to Mr. P. H. Abbot, of Walbrook-buildings, the agent of Mr. Spilsbury.

Communications are received from—X. M. N. R.—A Bad Pen-Slitter—R. Turner—Bung—Dixon Vallance—Z.—An Old Toper—Humanitas—Inventor—Sirrom.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

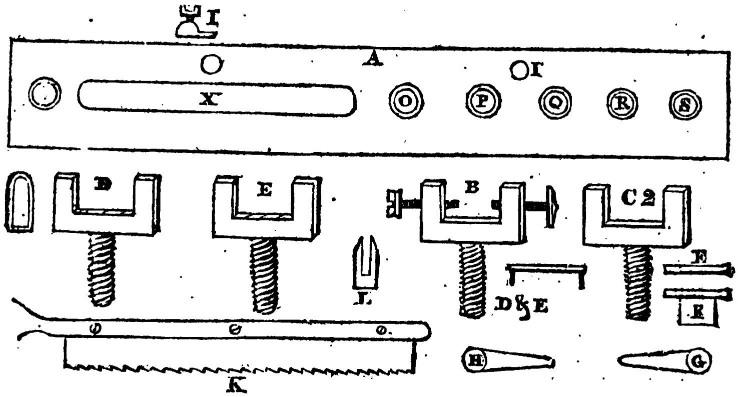
No. 106.] SATURDAY, SEPTEMBER 3, 1825. [Price 3*d*.

"The soul of man (let man in homage bow,
Who names his soul), a native of the skies!
High-born and free, her freedom should maintain,
Unsold, unmortgag'd, for *Earth's* little bribes.
* * * * *
* * * * *
Of *Earth* suspicious. Earth's enchanted cup
With cool reserve light touching, should indulge
On *immortality* her godlike taste;
There take large draughts—make her chief banquets *there*.

Young.

MACHINE FOR CUTTING TRELLIS-WORK.

INVENTED BY ARTHUR DIMOND, 21ST MAY, 1823.



SIR,—I send you herewith the drawing and description of a Machine for Cutting Trellis-work, invented by the late Mr. Arthur Dimond, and first used by him for cutting the trellis-work of Messrs. Constable and Co.'s new shop, Prince's-street, Edinburgh. It was my intention to have sent you a copy only of the enclosed, but, from the circumstance of the inventor having died at my lodgings a few weeks ago, I thought it better to send you the original description in the autograph of the deceased. Your insertion of it in the Mechanics' Magazine will not only favour me, but will be held, on its pages, by a very numerous circle of shopmates in different parts of the kingdom, as a sacred memorial

of a most excellent workman and agreeable companion.

I remain, Sir,
Your humble servant,
JAMES YULE.

July 10th, 1825.

Description of the Drawing.

A, the frame in which the different beds or wire-supports are screwed. Length, 9 inches; breadth, 1¼ inch; to be held in a vice, B, placed in the centre of the frame. In this the wires are secured while cut. 2 of C, one placed at each end, which turns in an angular direction to keep the wires in a straight line while they are cut, having screws and washers, viz. FF. E is the support in which the saw or cutter works, and is open at the top; the saw, K, is made to move in the back by means of the screws in it, to suit any sized wire, and is always forced down till the back comes in contact with the top of the support E. The first cut the wire receives, E is placed in the holes P, Q, R, S, according to the length of the figure of trellis required, and D in the slit X. In D and E are two centres, which give the diagonal of figure; and according to the figure required, so are these centres placed. After these supports are properly placed, namely, in the proper angle after the first ends of wires are cut, they are reversed, and the spear, G, is pushed into the slit, to keep the wires straight, and the screw, Y, is forced against the wires to keep them together . in this manner we cut the wires the first time. The second time the support, E, is placed on the other side, in the slit, X, between B and D, and the one-half of the former distance taken. M is a slip of steel, which is placed in D, which fills the first cut, and two small pins are put in at the ends to keep it there, and above is placed the spear, H, to keep them fast. In this manner trellis-work is cut.

[L is a view of E and D, as seen in the direction DE.—J. YULE.]

USE OF THE SLIDING RULE.

SIR,—I trust that I need not make any apology for the liberty I am taking with some of the Problems of the Slide Rule, by G. A. S., and, as I make no doubt of his being a man of good sense as well as a man of science, he will not find fault with what I have done, having no other end in view but the good of my fellow-mechanics. The guage-points he makes use of must either be wrong, or he must have miscalled the numbers on the rule—a mistake very easily made, but which, if not corrected, would tend to puzzle or lead others into error.

I shall begin with his 9th Problem, Example 1st., page 227: his answer to this question is 23 solid feet. Now, I make use of Routledge's improved engineer's rule, and the answer upon this is 26¼ feet. The true answer by figures, thus: $\frac{16,43^2}{144} \times 14 = 26,24$ feet.

Example 2nd.—The answer is 45 feet very nearly; by Routledge's rule it is 46¼ feet, and, by figures, $\frac{19^2}{144} \times 18,5 = 46,36$ feet.

Problem 10th, Example 1st, is so very plain that it would hardly be possible to make an error, as it can easily be done by the head, without either figures or rule. But Example 2nd is of a very different description, and G. A. S.'s method of doing it, I am afraid, will rather tend to puzzle than instruct the young mechanic. Instead of taking twice the length, and 1-5th of the circumference, it is much better to take the proper length, and, after the mean circumference is found, it is very easy to find the diameter, which is the only true way to come at the solid content. Routledge's rule gives for answer to this question 312 feet full. By figures, first, $15 \times 12 = 180$ = circumference in inches, and $\frac{180}{3,1416} = 57,209$ = diameter; then $57,209^2 \times ,7854 = 2570,97$ = area of the section in square inches, and $\frac{2570,97}{144} \times 17,5 = 312,42$ feet, the true answer.

Problem 11, page 260—1, Example 1st.—The answer to this question is 78 gallons nearly. This answer, although not right, is not very far wrong. By Routledge's rule it is 78¾ nearly; by figures, $28^2, \times ,7854 \times 36 \div 282 = 78,6$ gallons.

Problem 12th, Example 1st, is much more incorrect; the answer given is 98 gallons nearly. By Routledge's rule it is 95¾ gallons full; by figures, $28^2 \times ,7854 \times 36 \div 231 = 95,96$ gallons.

I have now proved, by figures, that the answers given by Routledge's rule are correct; a single example more will prove that the two last answers

bear a proper proportion to each other. This is done by drawing the slide out of the rule and reversing it, or putting it in again the wrong way; the line C will then be next A. Set 282 on C, 78,6 on A, and against 231 on C is 95,96 on A; thus each divisor has its proper number of gallons which are contained in the same vessel.

This last example will prove the correctness of the measurement of any vessel, the contents of which are to be taken both in ale and wine gallons. I shall here conclude for the present.

I am, Sir,
Yours respectfully,
A MAN IN THE MOORS.

In the Moors,
On the 6th of August, 1825.

CALCULATION OF INTEREST.

SIR,—In my communication in your Magazine of the 18th of June (page 167, vol. IV.), which contained a new Method of Calculating Interest at Four per Cent., I mentioned that I would send a short method of the same nature at Five per Cent.

Every one knows (and the reason why, I presume) that, if any sum be divided by 7300, the result will be the interest at Five per Cent. Now, instead of this long division by 7300, we shall find that, if any *sum*, the interest of which is required for one day at Five per Cent., be divided by 3, 30, and 300, the quotients added to the *sum*, and the 10,000th part of this result subtracted, the answer will be given in decimals, inserting the decimal point four figures from the right hand.

It is evident that there is but one *actual* division here, which is by 3, the others being merely a repetition differently placed.

EXAMPLE.

Suppose the interest of 7,256,880*l.* is required.

1-3rd =	2418960
1-30th =	241896
1-300th =	24189
	994,1925
1-1000th	994
	994,0931 = 994*l.* 1*s.* 10¼*d.*

I could send methods to you, *ad infinitum*, to produce the same result; but it is impossible, I may safely say, for a shorter one to be devised.

I am, Sir,
Your obedient servant,
G. U. A.

21st June, 1825.

P.S. In my last I omitted to put, "at Four per Cent." after the words, "required for one day."

BUNTEM'S SYPHON.

SIR,—If M. Buntem were here (see page 190, vol. IV.) it would give me great pleasure to show him a *conical* Syphon, which I made almost forty years ago, with a bulb the same as his, and for the very same purpose too, but it was then thought troublesome to have it to fill; and that the syphon itself might more easily be inverted and filled, fixing a finger on each end, and placing it properly in the fluid to be drawn off.

As to the Barometer, I made one about the same time, which a gentleman took with him to America, into which I believe it is impossible for the air to find its way, put it into whatever position you will, unless you break the glass, or the tube be uncommonly wide; but Mr. Buntem's may be on a different principle to that made by,

Sir,
Your most obedient,
AWKWARD MECHANIC.

Halifax, 9th July, 1825.

SAFETY FROM CARRIAGES FALLING.

SIR,—In Number 90, page 88, of your Magazine, there is a plan to prevent Two-wheel Carriages from falling, by adding two small wheels to the shafts. But suppose the horse should fall (which he will do sometimes), would not the shafts be instantly broken in spite of every precaution, the hinder part of the carriage thrown up, and the company ejected from it into the street? I think that such an accident would be prevented by having the shafts to let down, the same as the shafts of a four-wheeled waggon, which may be seen every day in the streets; so that, if the horse should fall occasionally, the shafts only would fall, and the carriage would remain as upright as before. All the other parts of the

carriage might be made as Dixon Vallance proposes, except the shafts, which should be made as above.

I am, Sir,

Your very humble servant,

WILLIAM DOWNES.

111, Aldersgate-street.

REMARKS ON MR. PALMER'S SUSPENSION RAILWAYS.

(*See Mech. Mag. page* 287, *vol.* III.)

Mr. Palmer asserts that his plan will cause a great saving in embankments, bridges, culverts, and drains, and that the carriages will be moved on it with less friction and resistance than on the railways hitherto in use; averring that a horse can draw a load on it, when level, of 33,750 pounds two miles and a half in an hour, which on the best performing edge railway that he had heard of (that near Newcastle-on-Tyne), could move only 17,773 pounds at the same rate.

We should be greatly at loss to account for this superiority of performance of Mr. Palmer's railway, and even to suspect exaggeration, could we not see, in the nice adjustment of Mr. Palmer's apparatus, and in his curious contrivance to lessen the friction of his wheels (which we are, by-the-bye, inclined to attribute to its bringing a larger surface of the axle and hollow box of the nave into contact, instead of the oil being prevented by it from assuming the shape of a wedge, as Mr. Palmer asserts), somewhat to justify the validity of the experiment; to this we have to add, that the shape of the surface of this rail, which is the segment of a circle, and the hollow rim of the wheel being also of the same circular form, will at *first* give a great superiority to the performance of the apparatus, which the power of adjusting the level, or inclination of the rail by the wedges, to unusual nicety, must greatly assist. But as all these circumstances are equally applicable to the common double railroads of the edge form, we think that farther trials than those made previous to the publication of his book will be necessary, impartially conducted, with wheels, axles, and both parts of the apparatus, equally good and perfect in the other species of railroads, before the question can be fairly decided.

That the form of the surface of the rail and rim of the wheels, being segments of circles, will at *first* much facilitate the draft, as we have just stated, depends upon the well-known geometrical problem, that a circle described within another circle can only touch it in a point; therefore, as long as these forms continue perfect, the lateral friction of the projecting part of the rim of the wheel against the side of the rail will be avoided, and so long will a great source of resistance, which is experienced in other railroads, be overcome.

The Penryn railway, which was originally formed in this manner, had, at *first*, all the advantages stated; but, according to the authority of Mr. Benjamin Wyatt (for which see Repertory of Arts, second series, vol. III. page 285), the two circular surfaces of the rail, and of the wheel's rim, as they wore, excavated the latter so much, and caused it to fit so tight, as to occasion much friction, and make it necessary to change the wheels so often, that another form of rail and wheel became necessary; from which it follows, that *time* is needful in experiments of this sort as much as any thing else, and that it is requisite new kinds of railways should be in perfect operation for a reasonable period before their superiority can be allowed.

A railway of Mr. Palmer's construction has been erected at Cheshunt, near Waltham, to carry bricks from Mr. Gibbs's fields, about a mile, to the river Lea; it is constructed of wood, with posts about five feet high, and ten feet apart, as we are informed, and has the surface of the rail covered with an iron plate. Nothing, at present, can be learned from this experiment, but that the plan is feasible, which we never doubted; but, for the reasons stated, we must wait for the effect of wear and of the weather upon it, before we can decide how far the posts will maintain their upright position, and the rails their level, the first of which points we do not think sufficiently provided for by the patentee. In point of expense, a wooden rail can be no guide for those to be made of iron; and when formed of this latter material, we think the patentee deceives himself in supposing that his railway can be made cheaper than a common double one; for, supposing his made with rails of the same strength as they are, and of course requiring supports, as they do, at every three feet, or thereabouts, now his pillars being three feet at least above ground, and as much more below the

earth (according to his drawings), and requiring to be of considerably greater substance, it is evident that they will take at least double the weight of iron for their construction, which would be necessary for the second rail, saved by his plan; and if, as he proposes, they be set farther asunder, nothing will be gained in this respect, since the rails then must be made so much stronger in proportion (to which must be added, that they must in all cases be made of double the strength of common rails, one of them having to sustain the load of two of these); and as for the lengths of ten feet between the posts suggested, their weight, to carry the usual loads, must be so much greater than that of any now used, that we much doubt if any of them, of iron solely, will ever be constructed.

That erecting numerous lofty pillars of iron, as proposed by the patentee, can cost less than embankments of earth (in general the cheapest mode known of raising an elevated surface), we cannot in any respect credit, and can still less give faith to the advantage of making railways of this kind ten feet high above the level of the earth, advocated by some of his friends.

We have further to remark, that loads carried as designed on this railway will, from their pendulous arrangement, be extremely liable to be knocked against the posts in high winds, to the great damage of the goods carried, as well as to the obstruction of their conveyance, which, in case of a storm, blowing across the rail, may be sometimes so great as to render the railway totally impassable for the time of its duration.

The injury from unequal loads at the two sides of the carriages, we do not think would be found so slight as asserted by the patentee, who states, that all acquainted with *geometry* must be of his opinion on this point. Now, in the first place, it remains with him to show what problem of geometry can be brought to bear on the question, and that he has not used the word geometry here in the vulgar sense of equilibrium; and, in the next place, to point out how he prevents the danger incurred by the oblique position of the wheels, which this must occasion, of the carriage being entirely dismounted. The rods which connect the loads with the axles, being jointed to them so as be at right angles to them in all their oscillations (which, we suppose, is what is meant by their being *inflexible*), though it will, when the centre of gravity of the load is placed below the rail, keep them from tumbling off directly, yet will not prevent the risk of the accident mentioned, while it will increase that of their being knocked against the posts.

In conclusion, were we obliged to decide on the question in the present stage of this experiment, which, however, we do not wish to do, we would say that the plan of single railways should be confined to that species of them constructed at Cheshunt, as they would be much too costly if formed of iron, for the reasons before stated. The great defect of the wooden framing would be its want of durability, and the expense of its repairs, particularly in the posts, which would be extremely liable to rot at the level of the ground; for which, in order to show that we have no ill will to the plan, from being able to see its defects, we will point out a remedy which will make them more durable and facilitate the repairs—which is, to have square cast iron sockets, two or three feet long, placed so as to occupy this portion of them, let down firmly, for half their length, on the lower part of the posts, secured in the earth as before described, and the other half forming a receptacle for the bottom of the upper portion, which should be formed so as to project a little beyond it at every side, to throw off the rain; and in order that the fitting between the wood and the iron socket might be more perfectly tight, the wood in this part should be previously impressed by screws—a method already practised to great benefit in the preparation of staves for casks; to facilitate which process we have advised the sockets to be made square instead of cylindrical—a form which, in other respects, might at first appear more advisable.

Repertory of Patent Inventions.

SINGLE-WHEEL CLOCK.

SIR,—Having seen, in your valuable work (page 319, vol. III.), an account of a clock with one wheel, by B. P. C. No. 10, Wolcot-place, Lambeth, I immediately set to work, and made one according to his direction; but when finished, I was disappointed to find it did not answer. The clock, when wound up, unwound itself in two

minutes: we could not, by any weight, prevent its rapid descent.

Length of the line............4 feet.
Spindle................1 foot 1 inch.
Wheel diameter............4 inches.
Tin barrel ....7 inches.

I should feel very much obliged if B. P. C., through the medium of your valuable publication, would give us the measurement of his clock.

I am, Sir,
Your obedient servant,
A Subscriber and Journeyman Carpenter.
Royston, July 15th, 1825.

HYDROSTATICS—SINGULAR FACT.

Sir,—Mr. N. Webster has recently, in several parts of Cornwall, delivered courses of very useful lectures on Experimental Philosophy. During the course which he delivered at this place, he showed us the following experiment:—A cylindrical vessel full of water was placed on the table; through an aperture in the side of it, a certain quantity of the fluid was discharged in 24 seconds. A straight tube was then attached to the aperture, and the same quantity of water flowed through it in 21 seconds; on the straight tube being exchanged for a diverging conical tube, the water passed in 18 seconds.

The cause of this effect, Mr. Webster observed, has not yet been explained by philosophers; and the manner in which that gentleman accounts for it is the following:—It is well known, that the figure described by a stream of water, issuing forcibly from an aperture in the side of a vessel, is that of a converging cone; and the reason why the diameter of that part of the stream which is near the orifice is greater than that of any other part of the stream, is, I imagine, owing chiefly to the pressure within the vessel towards the orifice, operating not only in a line in the direction of the axis of the stream, but also in lines proceeding from every direction in the interior of the vessel; thereby giving to the particles of the fluid a tendency, on issuing from the aperture, to fly off in diverging lines; but as the momentum of such minute particles is very inconsiderable, this diverging tendency is soon overcome by the mutual attraction of the particles, and the stream thus gradually diminishes in diameter until it reaches the earth. Now, Mr. W. considers that the tube, when applied to the aperture, draws, by its capillary attraction, a portion of the stream towards its internal upper surface, and passes it along that surface until it reaches the extremity; peventing, by this means, the stream from assuming its natural converging conical form, and producing a sort of vacuum in the stream, which the water from the vessel immediately rushes to supply.

This is the opinion of Mr. W. on the principle by which the effect, now under consideration, is produced: but as it is not at all satisfactory to me, I beg to submit an opinion of my own to the judgment of your scientific readers.

When the water issues from the mere orifice, without any tube affixed, as the lines of pressure towards the aperture proceed from every direction within the vessel, they must, by acting against one another, diminish considerably the effect of the aggregate pressure, and consequently diminish also the quantity of water discharged in a given period; but when the tube is affixed, and the water flows from the end of it, the whole pressure exists nearly in a line with the axis of the stream, and therefore acts in the most advantageous manner to facilitate the discharge of the fluid, without one part of the pressure impeding another part. And if, from the cause I have just mentioned, there be any impediment to the free passage of the water from the vessel into the tube, and a vacuum should thereby exist in the tube, that vacuum would instantly be supplied, by its affording a greater facility to the passage of the water through the orifice. Another circumstance which conduces to the more rapid discharge of the water through the tube, than through the mere orifice, is, I consider, the pressure of the water in the vessel

continuing to act on the stream after its passage through the orifice, by which continued pressure the stream acquires a progressive increase of velocity, until its discharge from the extremity of the tube. That more water should flow in a given period through a diverging conical tube, than through a straight one, is, perhaps, owing to the friction of the stream being less in the former than in the latter; but care should be taken that the tube be not so wide as to allow the admission of air into it whilst the water is flowing.

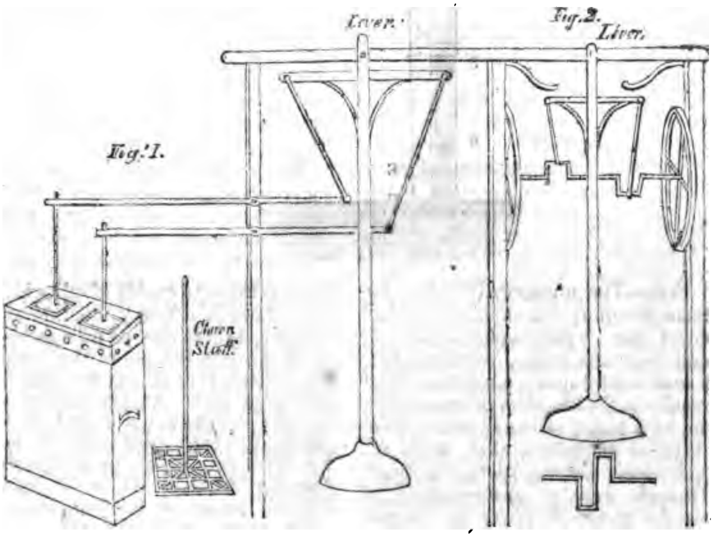
Such are my ideas on this subject; if they be erroneous, I shall feel indebted to any of your Correspondents who will correct them.

I am, Sir,
Your very humble servant,
P. E.

Redruth.

NEW APPLICATIONS OF THE LEVER POWER.

BY MR. DIXON VALLANCE.



Sir,—I send you herewith a sketch of two new applications of the power of the Lever;—one to the working of a Milk Churn, and the other to the working of a Wheel with a double crank.

Description.

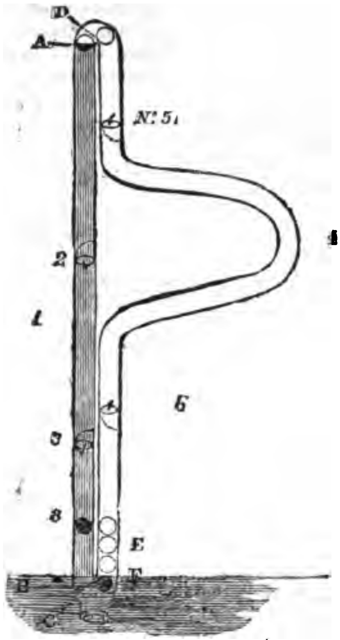
Fig. 1st represents the milk churn, with two churn-staffs, wrought by the lever. The two churn-staffs descend and ascend alternately; there is a small fillet down the middle of the churn, on each side, to keep the churn-staffs from coming in contact. The churn is four feet six inches in height, nineteen inches long and nine wide; the cover, or lid, is in two pieces; the hole for each churn-staff is surrounded with a square hopper, to keep the milk from running over in the act of churning. The small dots round the upper part of the churn are air-holes.

Fig. 2nd is a lever applied to a wheel with a double crank.

I am, Sir,
Your most obedient servant,
Dixon Vallance.

Libberton, by Carnwath,
Lanarkshire.

PERPETUAL MOTION.



SIR,—The unsuccessful (but far from *fruitless*) search made to discover the "philosopher's stone," and the "elixir vitæ," were productive of most important and beneficial results in the kingdom of chemistry; so, by a parity of consequence, I am disposed to believe that, from inquiry after the "perpetual motion" (though equally unsuccessful), a similar good will result to the mechanical world. After this apology for those who may sometimes think (and myself amongst the number) upon this much ridiculed, and now almost totally exploded, subject, I beg leave to offer to your notice, and for the momentary amusement, perhaps, of some of your readers, the prefixed device. The point at which, like all the rest, it fails, I confess I did not (as I do now) plainly perceive at once, although certainly it is very obvious, and will be, no doubt (as I shall leave it to be), immediately pointed out by some of your Correspondents. The original idea was this—to enable a body which would float in a heavy medium and sink in a lighter one, to pass successively through the one to the other, the continuation of which would be the end in view. To say that valves cannot be made to act as proposed, will not be to show the *rationale* (if I may so say) upon which the idea is fallacious.

The figure is supposed to be tubular, and made of glass, for the purpose of seeing the action of the balls inside, which float or fall as they travel from air through water, and from water through air. The foot is supposed to be placed in water, but it would answer the same purpose if the bottom were closed.

Description of the Engraving.

No. 1, the left leg, filled with water from B to A.

2 and 3, valves, having in their centres *very small* projecting valves—they all open upwards.

4, the right leg, containing air from A to F.

5 and 6, valves, having very small ones in their centres—they all open downwards.

The whole apparatus supposed to be air and water tight.

The round figures represent hollow balls, which will sink one-fourth of their bulk in water (of course will fall in air); the weight, therefore, of three balls resting upon one ball in water, as at E, will just bring its top even with the water's edge; the weight of four balls will sink it under the surface until the ball immediately over it is one-fourth its bulk in water, when the under ball will escape round the corner at C, and begin to ascend.

The machine is supposed (in the figure) to be in action, and No. 8 (one of the balls) to have just escaped round the corner at C, and to be, by its buoyancy, rising up to valve No. 3, striking first the small projecting valve in the centre, which, when opened, the large one will be raised by the buoyancy of the ball; because, the moment the small valve in the centre is opened (although only the size of a pin's head), No. 2 valve will have taken upon itself to sustain the whole column of water from A to B. The said ball (No. 8) having passed through the valve No. 3, will, by appropriate weights or springs, close; the ball will proceed upwards to the next valve (No. 2), and perform the same operation there. Having arrived at A, it will float upon the surface three-fourths of its bulk out of water. Upon another ball, in due course arriving under it, it will be lifted quite out of the water, and fall over the point D, pass into the right leg (containing air), and fall to valve No. 5, strike and open the small valve in its centre, then open the large one, and pass through; this valve will then, by appropriate weights or springs, close, the ball will roll on through the bent tube (which is made in that form to gain *time* as well as to exhibit *motion*) to the next valve, No. 6, where it will perform the same operation, and then, falling upon the four balls at E, force the bottom one round the corner at C. This ball will proceed as did No. 8, and the rest in the same manner successively.

I am, Sir,

Your most obedient servant,

PHILO MONTIS.

MANAGEMENT OF BEES.

SIR,—Your valuable Magazine contains, in the Number published the 9th ultimo, remarks on Bees. Allow me to beg the favour of your Correspondent to oblige, by additional communication on the subject; and I am sure many of your readers will feel equally interested in any information he may give on his most approved management of the bee-hive, in round-top hives, in the flat hive, and under glass; and likewise the humble-bee; stating particularly the form of hive best adapted for the latter, the time of procuring them from the fields, and the quantity of honey which may be obtained from them, when brought into a domestic state.

I am, Sir, yours truly,

J. MEL.

Wingham, Kent, Aug. 18th.

SUGGESTED IMPROVEMENT IN PRINTING PRESSES.

SIR,—In the 95th Number of your Magazine, I find a copy of a descriptive drawing of Mr. Henry Russell's Improved Printing Press, which, on account of the advantages arising from his peculiar application of Lord Stanhope's principle, the adjusting screw, and his useful contrivance of the wheel and rack, I consider to be an excellent piece of machinery, and well worth the consideration of those for whose service it is intended. But my object in this paper is to suggest, with your permission, something to Mr. Russell, which, if practicable, will, I think, add considerably to the general usefulness of his press.

I wish to ask that gentleman, if he is acquainted with any small machine that could be applied to his press, to denote, with indexes, at any time the exact number of sheets pulled. I have been informed, that a machine, answering a similar purpose, is now used in the toll-house, at the Strand Bridge; but I am quite ignorant of the principle of its construction. It appears obvious to me, that if this mode of numbering were adopted in printing, it would

be found very convenient to the workmen, as well as profitable to their employers and to the public. It would entirely do away, in a printing-house, with what are called *imperfections*, or, at least, it would detect the pressmen when they omitted to regulate it, and consequently render them liable to be responsible for the deficiency in the number of sheets. It would likewise be a very great saving to those publishers who are now obliged to use as waste paper nearly the whole of valuable copies of works, on account of the great expense of reprinting the parts wanting. The public, too, would be more certain of purchasing complete books; and this is of great importance where the portions of a work are necessarily connected throughout. Persons are often deceived with incomplete copies at auctions, where they are offered as being both new and *perfect*.

I am, Sir,
Your constant reader,
T. C—N.

Derby, Aug. 24th, 1825.

DENSITY OF THE EARTH.

SIR,—The favour you have already conferred on me, in obtaining information through your numerous enlightened Correspondence, on several subjects, makes me lament my incapability of contributing in turn to their edification. But as where little is given, little can be required; and, no doubt, where much is, freely will it be imparted. I request to be informed, *wherein consists the utility of ascertaining the mean density of the earth?* My short-sightedness can see no real utility in it; but as it is considered a *desideratum* in science, and as so much learning has been displayed in solving the problem, there must certainly be much importance connected with the answer, to which such great interest is attached.

I conceive, that if space be a vacuum, and matter perfectly inert, there is nothing to resist the planets; neither can they resist whatever moves them. If, on the other hand, space be a plenum, the matter of which moves the planets, resistance is equally out of the question. Matter filling space without being in motion, seems contrary to the rigid economy of nature. Newton says space is empty; and if so, whence comes the resistance? or is it on some such account as this, that the mean density of the earth is sought after?

I am, Sir,
Your constant reader,
DUBLINI.

MEASURING HEIGHTS.

SIR,—Through the medium of your valuable Magazine, permit me to request your insertion of the following general rule, in addition to what has been said in No. 67, p. 168, on the Measuring of inaccessible Heights and Distances, deduced from the equation there given.

"Multiply the given distance by the least or farthest observation, and divide the product by the difference between the two observations," and the quotient will give the distance of the object from the nearest station. Thus the two observations being 47 and 73, and the distance 40. $40 \times 47 = 1880$, and $\frac{1880}{73=47} = 72.3 =$ KG; having which, the height may be found as there described.

I think your Correspondent R. H. will find that, *in practice*, this rule will be found not only more accurate, but more expeditious, than the one he has proposed in No. 98, p. 217, for finding, *by trials*, one-tenth of the height, the least inaccuracy of which must, of course, be increased ten times. I therefore conceive, it will be better to let the sights remain on the side AD, than remove them to the side DB, which is the principal difference in the two instruments; for it matters not whether the shape be that of a quadrant or a square, farther than, as a square, we perceive at once that the base is supposed to be divided into 10.100, or 1000 equal parts; and that shape is also more convenient for con-

structing a wooden frame with loose mortice and tenon joints, that will take to pieces and go into the pocket.

I am, Sir,
Your most obedient servant,
S. M.

August 16th, 1825.

SAFETY FROM CARRIAGES FALLING.

Sir,—Observing in your last Number a paper from Mr. Matthews, the inventor of the Safety Coach, on a contrivance for preventing accidents arising from Horses falling with Two-wheeled Carriages, I am induced to trouble you with the following observations on the same subject.

A premium having for some years back been offered by the Society of Arts, &c. for a similar invention, I was led, four or five years ago, to turn my thoughts to this reward. Now, as it must be evident, on the slightest consideration, that the only thing wanted in this case, in the event of a horse falling, is to preserve, as nearly as possible, the horizontal position of the shafts, or the body of the vehicle, I was very naturally led to adopt means to support the former, for the reasons hereafter stated. I mentioned my idea to some of my private friends, and amongst the rest, to that clever mathematician the late Mr. Anthony Cook, Master of the Trinity House School, Newcastle, who expressed his high opinion of the utility of the invention. I was, however, ultimately led to abandon the idea of communicating the same to the Society, on considering the *extreme simplicity* of the contrivance—a thing which I thought so self-evident, that had it possessed any merit, it would doubtless have been long before brought into practice. I have since, however, been much gratified by observing, in many instances, a modified adoption of my plan, by the steps of gigs, &c. being placed more forward on the shafts, and approaching to within a few inches of the ground. This method I consider to be far preferable to that described by Mr. Matthews, because the shafts being thus supported, and prevented from coming to the ground, it will not only preserve the body of the vehicle nearly horizontal, but will, in the event of the horse stumbling, afford him a support, and enable him to recover himself—a desideratum which Mr. M. does in nowise provide for. But the advantage of supporting the shafts, over Mr. M.'s plan, will be still more apparent when a horse falls in going down a steep declivity, as it will then be evident that the safety-irons will be of little or no avail, in consequence of the great declination of the road, and as the sudden stoppage would not fail to precipitate the person out of the vehicle; whilst, by the other method, as the horse would be prevented from falling, the vehicle would continue to move on, and consequently the danger of a sudden transition from motion to rest would be avoided.

I am, Sir, yours truly,
T. Bell.

Commercial-road, Whitechapel,
Aug. 21st, 1825.

P.S. In my communication, page 270, col. 2, l. 13, for mechanics, read "Mechanicus."

SECRET IN SELLING.

Sir,—In Number 62, p. 94, is "A Secret in Buying"—thirty-two gallons in winter, which will be thirty-three in summer. But perhaps the *vessel* in which it was measured may *vary* a little by that time. Permit me here to ask, is there not as great a *secret* in selling very *light* articles (which fetch a high price) by weight, *when* and *where* the barometer stands very low? It would be conferring a service on the public, if any of your philosophical Correspondents would be so condescending as to make a satisfactory calculation on this subject.

I am, Sir,
Your obedient servant,
C. M.

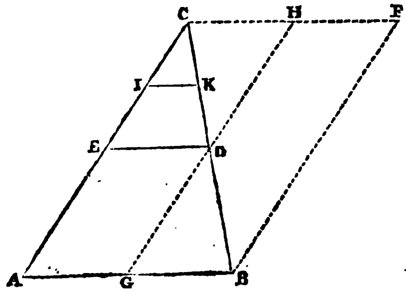
MECHANICAL GEOMETRY.

(*Continued from our last, page* 334.)

THEOREM V.

In any triangle, if we draw a line parallel to any one of its sides, it will divide the two other sides in the same proportion.

Let ABC be any triangle, and let the line ED be drawn parallel to AB, we have to show that the side BC will be divided in D, in the same proportion as the side AC is divided in E; that is, for instance, if BD equals DC, AE will also be equal to EC; that is (according to definition 6), as BD : DC : : AE : EC.



Let the triangle ABC be drawn, and suppose, for instance, we divide the side BC into two equal parts in the point D, then is BD equal CD; now draw DE parallel to AB, then, if we mechanically measure AE, we shall find it correspond to EC, or that AC is also divided into two equal parts in the point E.

Or, more geometrically, from B draw BF parallel to AC, and CF parallel to AB; then, if through D we draw DGH parallel to AC, we shall have the two triangles, CDH and BDE, identical, as the angle CHD is equal to the angle BGD, and the opposite sides are equal by construction; and also the angle CHD is equal to the angle BGD; and, of course, the third angle at C and B equal, they will correspond in all respects, or the remaining side will also be equal; hence GD equals GH, but DH equals HC, because of the parallels HD and CH to the lines EC and ED, and GD equals AE, for the same reason; hence AE equals EC; but BD equals DC, or the lines AB and BC are divided in the same proportion, and this will hold good, whatever proportion the lines CD and DB bear to each other; for if we draw IK parallel to ED, so that CK equals, for instance, the quarter of CB, IC will be equal a quarter of CA, for CE equals half CD; and we have shown, that when CB is divided into two equal parts, CA is divided also into two equal parts; hence CI equals half CE, and, of course, equals a quarter of CA; that is, as CK : CB : : CI : CA; that is, the lines CB and CA are divided by the line IK in the same proportion, viz. as 1 to 4, which was to be shown.

COR. 1.—Hence, if we draw two or more lines parallel to the base of a triangle, it will divide the other two sides in the same proportion.

COR. 2.—Hence, also, any line drawn in a triangle parallel to the base, cuts off another triangle from the vertex, similar to the original triangle, for all the angles in the one are equal to all the corresponding angles of the other, and their sides proportional (by Def. 21, Part

1.); for the triangle ABC is similar to the triangle EDC or IKC, because the angles are all equal, and the sides have (by this proposition) been shown to be proportional.

Cor. 3.—Hence, likewise, we see, that in similar triangles the sides that are opposite the angles that are equal to each other, are proportional to each other; that is, the side AC, in the triangle ABC, is to the side EC, in the triangle EDC, in the same proportion as the side BC, in the triangle ABC, is to the side CD, in the triangle EDC; that is, as AC : EC : : BC : CD.

G. A. S.

(*To be continued.*)

RISE OF QUICKSILVER IN THE TORRICELLIAN TUBE.

Sir,—I will be much obliged to some of your numerous Correspondents to inform me, through the medium of the Mechanics' Magazine, if it be the fact, which I have met recorded in some scientific work, the name of which, and particulars of the case, I have now no recollection of, that quicksilver stands supported, in a Torricellian Tube, at times, as high as seventy inches. It is said to be only accidentally so, but the phenomenon cannot happen without a cause; and when it is recollected, that the barometer never ascends, from atmospheric pressure, to thirty-five inches (which one would suppose is the cause in both instances), I confess it puts my faith in the recital to no small trial. Seventy inches of quicksilver, giving seventy feet ascent of water, is what no pump-sinker ever obtained yet. Being anxious to investigate the subject, I have searched many philosophical works lately, but could meet nothing of the case; yet being strongly persuaded it is mentioned as having taken place, and, of course, is worthy investigation, I beg to solicit your publishing this my request, to be informed whether it is the fact, and on what principles it takes place,

As my last Hope.

HEATING ROOMS.

Sir,—I have for some time been at great expense and inconvenience, from not being able to accomplish the heating a room with warm air (*impartially*) to a sufficient degree, and should feel greatly obliged if you would allow my inquiry a place in your useful Journal.

What is the best means of attaining one hundred degrees of Fahrenheit in a room of 12 feet square?—I have tried the design given in your 49th Number, but find it insufficient to my purpose.

I should also be indebted, if Mr. Vallance would favour me with a more explicit explanation of his principle upon that subject. The system proposed in Number 35 does not procure the heat required.

I am, Sir,
Your obliged servant,
D. C.

Brighton.

INQUIRIES.

NO. 140.—GILDING OLD PICTURE FRAMES.

Sir,—It would very greatly oblige me if any of your intelligent readers would inform me of the mode of gilding old picture frames in oil gold—whether there is any method of varnishing them with gold varnish, so as to look well and stand? The great expense of frames in this country deprives those who are not rich of the pleasure of ornamenting their rooms with their own paintings or drawings, and consigns many a good old family picture to the garret, from the shabbiness of its frame. It has occurred to me that some of your ingenious Correspondents at Birmingham might make frames of metal, lackered as they do ornaments for chairs, tables, &c.: they would be durable, light, and cheap. Mouldings might be made of any convenient length, and various breadths and patterns, so as to be cut and jointed to any size wanted. Mould-

ings for rooms might also be made much less expensive than the present gilt ones. We should not then be struck by the bare dead wall of an English drawing-room, so often remarked by foreigners and all who have been long out of England. The very high duty upon glass is also a great drawback upon the beauty of our houses, and quite a misfortune to the florist, who cannot afford that most expensive article of luxury in this uncertain climate.

I am, Sir,
Your humble servant,
M——.

NO. 141.—EFFECT OF HOT WATER ON RAZORS.

Sir,—Why does a razor cut better after it has been dipped in hot water? The above query, answered on philosophical principles, will oblige, Sir,

Your obedient servant,
Novacula.

NO. 142.
QUESTION IN TRIGONOMETRY.

Sir,—Standing on a plane with a Theodolite, required a method to determine the distance and elevation of a tower, or any similar perpendicular object, from *one station*, the horizontal distance of the object not exceeding five or six hundred feet.

I am, Sir,
Yours respectfully,
Thomas Henry Bell.

Alnwick.

NO. 143.—MACHINE FOR PRESSING STRAW BONNETS.

Sir,—Permit me, through the medium of your valuable Publication, to request one of your numerous and ingenious Correspondents to dedicate a small portion of time to the service of a numerous class of the fair sex, in forming a cheap and useful machine for the purpose of pressing Straw Bonnets, which are at present done by a common ironing-box, by leaning with their whole weight upon their side, which is at all times a very hard and laborious employment, and often causes violent pains of the side, and sometimes produces more serious consequences. If some simple machine were invented, and a sketch inserted in your excellent Magazine, it would confer a lasting obligation upon a large portion of the fair, and ensure their eternal gratitude.

I am, Sir,
Your humble servant,
W. C—R.

M—ld—n.

NO. 144.—MAKING LENSES.

Sir,—A description is wanted of the best method of making Lens Glasses, the most simple and easiest plan of grinding them, together with the ingredients and instruments used in the whole process of forming a good magnifier.

I am, Sir, yours, &c.
D. J.

NO. 145.—WIND-LATHE.

Sir,—Having a workshop in the centre of a town, and in which I have a Lathe, which I wish to work by sails, on the principle of a windmill, but which must have the sails in a horizontal position, I wish to know how this would act; and will thank any of the contributors and Correspondents to your Magazine to favour me, through its medium, with a plan or description of this sort of wind-engine. I should wish the description to state how many arms there should be, and whether every other arm should dip or not, to catch the wind better. Any other information on the subject, either derived from personal experience, or from books, or otherwise, will be very acceptable, as I never saw a movement of this description.

I remain, Sir,
Your very obedient servant,
E. B.
Cabinet-maker.

Skipton, near Craven.

NO. 146.—BORING FOR COAL.

SIR—The present very high price of fuel is severely felt by manufacturers consuming quantities of Coal for the purpose of steam-engines, and the extra demand, arising from the manufacture of gas, makes it probable, that unless some means are used to increase the quantity brought to market, there will still be a further increase upon the price of that important material.

In order to effect this desirable object, would it not be a study worthy some practical men, to endeavour to adopt some means of ascertaining where coal may be found?

The present plan of boring appears to have received very little of that attention so evident in other pursuits, although its vast importance so much requires it.

With the exception of a plan proposed in your valuable Miscellany, a few weeks ago, for procuring water, I do not recollect seeing any thing noticed upon the subject. Could there not be an instrument invented, of the form of a tube, with teeth on the bottom-edge, and springs inside, that would secure the core, when charged with it, and show the strata through which it has perforated?

If something of the kind be found that would operate to the depth of 130 yards, I know a person who would at once have an experiment tried to prove an estate, where there is very little doubt of coal; but, from the old expensive and ineffectual method of boring, has been deterred from the attempt.

An answer from any of your Correspondents who can accomplish the object, would oblige,

A constant reader,

Z.

P.S. There is a shaft, 30 yards deep, before the water is found, on the estate.

ANSWERS TO INQUIRIES.

NO. 134.—STUCCO IMAGES.

SIR,—I intended to have replied to Aurum's first inquiry, but forgot the circumstance until reminded of it by his letter in a late Number. If he will wash the figures in a strong solution of alum, I think his expectations will be fully answered. I had the information from a friend (a modeller) who always makes use of it for that purpose, and I also understood that its effects were but little known. The figures, when dry, appeared to have acquired considerable hardness on the surface, and seemed capable (when rubbed) of taking a pretty good polish. I should conceive, therefore, that a varnish might afterwards be applied, without sinking, in the manner described by Aurum.

I remain, Sir,
Your obedient servant,
X. M. N. R.

Old Change, August 23, 1825.

P.S. Your readers might probably wish to know how far it answers his wishes.

A friend informs us, that he has made use of alum for the purpose with great success, but in a manner somewhat different from that suggested in the preceding letter. He immersed the images in a strong solution of alum, which he put on the fire for four hours, and then set to cool. On taking out the images, they had acquired all the appearance, and, in some degree, the consistency of alabaster. The images must not, however, be *hollow*, like those usually sold by the Italian boys; but either cast entire or filled up, in the manner, perhaps, suggested in the following communication.—EDIT.

SIR,—Permit me to inform Aurum, that my plumber has had for the last five years a figure of Neptune, and others, in his shop, which

I always took for leaden figures; but, one day, the base of one of them having a bit broken off, and it leaving a white mark behind, on inquiry, I found they were plaster figures painted, and once a week thoroughly cleaned with a black lead brush, which gave them this leaden appearance. To prevent their breaking, I would advise Aurum, as soon as he buys a figure, to get some chalk or plaster, and make a thick mess of it; then place the figure on its head, fill it with the mess, and let it stand so till it dries up in the figure.

I am, Sir, with due respect,

CLIO.

SIR,—I am happy to have it in my power to supply the "further explanation desired," on the Varnish for Plaster of Paris Figures. The proportions are as follow:—Of white soap and white wax each half an ounce, of water two pints; boil them together for a short time in a clear vessel. The varnish is to be applied, when cold, by means of a soft brush—an old shaving-brush will answer the purpose very well. I have not tried the processes recommended in your last by W. Tatner, but I am inclined to think that, besides the additional trouble and expense, neither of them is as likely to answer as that which I have supplied.

I cannot withhold from expressing the great satisfaction which I have experienced in witnessing the success which attends your work; and I am particularly gratified with the increasing and combined efforts of all classes to promote the improvement of the labouring population.

I am, Sir,
Your faithful coadjutor,
WM. JOHNS, M.D. F.L.S.

CORRESPONDENCE.

In the 4th Number of the Mechanics' Magazine, there is a description of a Double Door Spring, invented by "Mr. James White, of Laystall-street." A Correspondent says, that, up to this time, he has not been able to find out where the article is to be met with. About last September, a friend, whom he requested to procure one, traversed Laystall-street from end to end, without being able to find such a person as Mr. White, or any place where such an article was to be sold. He farther inquired of a carpenter, who was at work in the street, and who said it was not the first time he had been asked the same question, which he could not satisfactorily answer. He therefore requests to know where Mr. White's door-springs are to be procured?

P. M. O. would feel obliged to G. Brown, if he will say where the Bug-Destroying Machine (described in Number 92, p. 123) is to be purchased, or who made his for him? He has shown the drawing to a tinman in his neighbourhood, but he will not make it for twice the sum G. B. says he paid for his.

We shall endeavour shortly to gratify Mr. K. and friends, by a description of the Machine alluded to. An account of Mr. K.'s new Picking Machine will be acceptable.

J. N. says, he "cannot resist an inclination to trouble our readers with some ideas on the neglect of Cosmogony." We are sorry we cannot give him leave so to trespass on their attention.

Sir Sydney Smith's Six-wheeled Carriage in our next.

Communications received from—An Old Sailor—R. S. S.—H. M.—D. W.—G. M. E.—Amicus—A Learner—Tyro—J. G. C.—William Grant—An Original Subscriber—Thomas Martin—M. M. (Wilts)—M. M. (Edinburgh)—"A Few Inquirers at Leeds"—U. T.—L. S.

T. M. B. will find a letter for him at our publishers on Monday.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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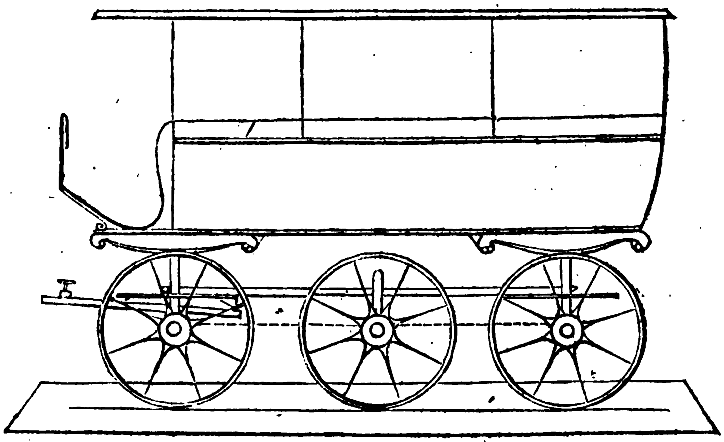
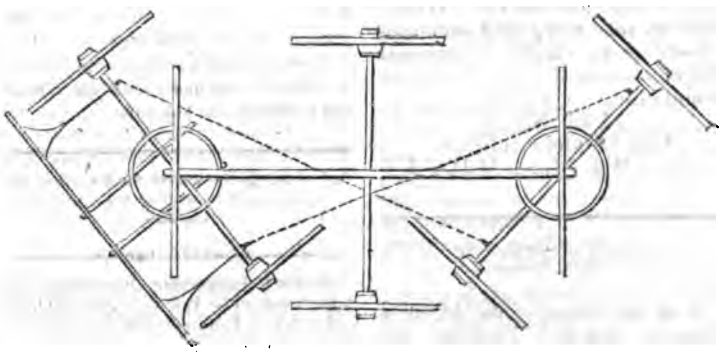
"Were not genius and invention seconded by industry and perseverance, the brilliancy of genius would be merely the blaze of a passing meteor, and the cunning of invention would be rendered of no avail."—*The Idler*.

SIR SYDNEY SMITH'S

NEWLY-INVENTED

SIX-WHEELED CARRIAGE.





SIR SYDNEY SMITH'S SIX-WHEELED CARRIAGE.

SIR,—I now send you, as promised, the accompanying drawing of SIR SYDNEY SMITH'S newly-invented *Six-wheeled Carriage*, for the favour of a place in your useful Magazine.

As I stated in my former communication (No. 87, page 37), its great advantage over the ordinary four-wheel carriage consists in the ease and facility with which it travels on any rough or uneven surface; and as it acts upon a principle of leverage, from its counterpoise motion on the centre wheels, it thereby preserves the *body* part from that uneasiness which any violent action of the extremities or end wheels, in their continued ascent or descent, on uneven pavements or bad roads, must otherwise occasion. It is, therefore, particularly adapted for the service of *invalids* and individuals requiring the greatest possible ease in their conveyance from one place to another. It is likewise of important utility as a *military carriage*, for conveying the sick or wounded, as it would give great relief to the sufferers, and tend materially to the preservation of life on long journeys and fatiguing marches, where the ground to traverse over is bad and unlevelled.

As a *sporting carriage*, in crossing open countries, it possesses many advantages, for the body can be formed with seats to carry several persons, with every necessary convenience for containing dogs and game.

The six-wheeled carriage can be constructed as a *low phaeton*, to be drawn by poneys, for the sick and invalid, the body part to swing on leather braces, and to contain a cot or couch to lie or recline upon, for the convenience of ease and support, as might be found necessary.

As both pair of *end* wheels revolve laterally, the horses may be attached to either part of the carriage.

Should any person be desirous of having a carriage on the six-wheel principle, every particular respecting it may be had by sending an address to No. 25, Bow-street, Long Acre.

I remain, Sir,

Your obedient servant,

G—— M——.

DIRECTIONS FOR TANNING.

The following is copied from the manuscripts of the late Colonel Benjamin Hawkins:—

Green Hides.

Take them immediately from the carcase to the pond, and let them remain twelve hours: then put them in lime. One peck of black-jack ashes to a hide, if large, or half a bushel to three hides.

If the season is warm, in three or four days the hair will come; as soon as it will come, take it off. The first, second, and third day, work them well in the lime; do this by taking them quite out, and replace them; if necessary, add ashes, and always water enough to cover them. After they are haired, take them to the pond; the second and third day work each side well till the water or lime appears to ooze out of the hide of a dryish cast. The fourth day put them in beaten bark, so that no part of a hide lies on another bare. Here they are to lie nine days, and then be replaced in a second bark. Six weeks after, replace them in fresh bark, and let them remain in the tan.

Dry Hides.

To be soaked in the pond, in warm weather, seven days; in March, nine days; seven days in lime, and seven to take it out for warm weather; in March, nine or ten: every thing else the same as for green hides.

ENGLISH IRON.

A very important discovery has been made for the improvement of this leading article of our manufactures and commerce, and the success

which has attended the experiments which have taken place must be gratifying in a national point of view. It may not be generally known that, in smelting iron in its original state, a great quantity of carbon and other impure matter is found, which is dissipated in the farther process in converting it into bar-iron. The more it is purified by the present process, the more it becomes soft and flexible, and is thereby rendered comparatively useless for articles where strength, toughness, and hardness, are required; and thus the manufacturer is compelled to use foreign iron in the construction of such articles. An individual connected with the iron trade, possessed of practical scientific knowledge, has devoted the greater part of his life to numerous experiments on the subject. Success has crowned his efforts, by the discovery of a process by which he can recharge bar-iron, or manufactured articles, with a mineral carbon, so as to give the softest iron a considerable portion of the steel quality, making it as hard as blister steel, without destroying any portion of the toughness it had before acquired, and this can be accomplished at a trifling expense on a large scale. It may be presumed that, by bringing English iron nearer in quality to the foreign, it will create a demand for our own production, and supersede the necessity of using the latter, which is generally at a much higher price in the market.

TUNNELS IN ENGLAND.

The first Tunnel ever constructed in England was on the Trent and Mersey Canal, executed for the Duke of Bridgewater. It is about 2880 yards in length, and some parts cut out of the solid rock. The canal is 93 miles in length, and four other tunnels—131, 350, 573, and 1241 yards.

The Worcester and Birmingham Canal, of 29 miles in length, has five tunnels; one of 2700 yards long, 18 feet high, and 18½ feet wide; and four others—110, 120, 400, and 500 yards long.

The Leeds and Liverpool Canal has two tunnels, one of which is 1530 yards.

The Leicestershire and Northampton Canal has four tunnels, of 286, 880, 990, and 1056 yards.

The Leominster Canal has two tunnels, of 1250 and 3850 yards.

The Thames and Severn Canal has one tunnel of 4300 yards, or two miles and 3-8ths.

The Chesterfield Canal has two tunnels, one of which is 2850 yards in length.

The Crumford Canal has one tunnel of 2966 yards, and several smaller.

The Doudley and Owen Canal has three tunnels, of 623, 2926, and 3776 yards, or about four miles.

The Ellesmere Canal has two tunnels, of 487 and 775 yards.

The Hereford and Gloucester Canal, of 35½ miles, has three, of 440, 1320, and 2192 yards.

The Edgebarton Canal has four tunnels, of 100, 400, 500, and 2700 yards.

The old Birmingham Canal has two tunnels, one of a mile and a quarter, the other 1000 yards.

The Grand Union Canal has two tunnels, 1165 and 1524 yards.

The Grand Junction Canal has two tunnels, 3045 and 3080 yards.

The Oxford Canal has two tunnels, one of them 1188 yards.

The Huddersfield Canal, of only 19½ miles long, with a lockage of 770 feet, has a tunnel of three miles and 1540 yards, through a rocky mountain.

THE STEEL-YARD.

Sir,—Under the head of "Mechanical Difficulties," page 285, a Correspondent wishes to be informed, "why distance makes the pea heavier" on the steel-yard, by which a pea of one pound weight, on the long arm, balances a body of twenty pounds on the short arm. I do not wonder at your Correspondent being greatly "puzzled," for it must remain an everlasting puzzle, on the principle of weight being the effect of attraction; or, as W. X. says, "be it attraction or gravity." This case, with

many others, affords a demonstrative evidence, that no such principle exists as attraction; nor can all the mathematicians in the world elucidate the phenomenon, by the hypothesis that weight is the consequence of attraction. When the steel-yard is in equilibrio, with twenty pounds on one arm, and one pound on the other or longer arm, then, and in opposition to the theory of attraction, one pound is attracted to the earth as forcibly as twenty pounds; or, the weight of twenty pounds is not attracted more strongly than the weight of one pound. On the contrary, did the earth attract either, and according to their quantities of matter, both would be pulled by the earth towards the surface, and each with a force proportional to its quantity of matter, which would make the greater preponderate. Hence it is manifest that weight is not the consequence of attraction, as the equilibrium, under these circumstances, would be an impossibility.

It is well known that one pound will balance twenty in an opposite scale, both scales being suspended from a beam of equal arms, provided it be let fall into its own scale from a sufficient height; in which case, as soon as the one pound strikes the scale, the scale with the twenty is lifted up, and the beam is brought to a horizontal position; and as long as that position is maintained, the one is as heavy as twenty. Hence it may be reasonably inferred, that as motion creates weight, and "more causes than what are rational, and sufficient to account for phenomena, should not be resorted to," weight is the effect of motion universally. Again, as attraction of the earth for a certain quantity of matter must be considered a fixed quantity, acting on it inversely as the square of the distance, it should be the fact, that the momentum of a falling body is always the same at the end of the fall, no matter the length of descent. For it is highly irrational to imagine, that the motion of a falling body is the cause of the increase of that motion; and the body could be attracted at all heights, only as its distance from the earth. The customary phrase, "the effects of motion remaining in the body, and thereby accumulating, and hence the motion is accelerated," is neither rational nor intelligible. It follows, that as attraction is incapable of accounting for either the weight or fall of bodies, and would be a hindrance to all projectile motion, while weight is evidently caused by motion of a body, and motion is evidently the effect of the motion of some other body, there must necessarily be a medium, which is in motion, which is the cause of both weight and the fall of bodies; and hence it is, from the momenta of the unequal weight on the steelyard being equal, that the equilibrium is formed.

I remain, Sir,
Your obliged servant,
H——.

SHAWL MANUFACTURE.

Accidental circumstances lately called our attention to some facts connected with the history of the shawl manufacture, a short statement of which our readers may perhaps consider not without interest. We need scarcely state, that this species of manufacture has risen almost from nothing within the last thirty years, and that little more than twenty years have passed since it was established in this city, which may now be considered as the chief seat of the finest, though not the most extensive, branch of the manufacture. Shawls were originally made in the East Indies, and they exhibit a curious example of the high perfection to which some single species of manufacture may be carried in a country where the arts in general are in a rude state. So highly are these India shawls prized in this country, that they fetch a price of 100*l.*, 200*l.*, or even 500*l.*, while the best of those of domestic manufacture can be had for 20*l.* or 30*l.* But what makes the preference shown to the foreign article the more surprising is, that no small proportion of the India shawls brought to Britain have been worn by the natives as turbans, girdles, &c. before they were imported. This is no secret

among dealers, for the marks of wearing are often manifest to an experienced eye, in the discoloration or roughening of the surface, the attenuation of the fabric at particular places, and now and then in actual rents and holes. Strange as it may seem, therefore, it is literally true, that our wealthy and titled dames are content to array themselves in the cast clothes of our Eastern subjects, which vestments, notwithstanding, have no small intrinsic value!

There are two substances of which the body or fabric of fine shawls is made—silk and wool. Silk has generally been employed in Britain; but the Hindoos use an extremely fine wool, and from the use of this material the India shawls derive much of their superiority. First, it gives them an exquisite softness and warmth, to which it is impossible to approach when the fabric is chiefly of silk. Secondly, the fine wool takes a brighter colour than silk, and keeps it incomparably better. Thirdly, the woollen fabric has an advantage which is perfectly understood by the ladies; its folds dispose themselves in more graceful and flowing lines, and of course it affords a finer drapery to the figure. With regard to the patterns, it must be admitted, that till we have discovered the mode of working the figure practised by the Indians, and till our weavers can subsist on twopence a day, and spend three or four years' labour on a single shawl, we shall scarcely be able to rival them. In the brightness of the dyes we already surpass the Hindoos, and the figures on their inferior shawls, which are sewed in or embroidered, are not nearly equal to the best of those which we execute in the loom; but in the finest of the India shawls the figures are wove in a manner which we cannot perfectly imitate, and of which our weavers only comprehend enough to perceive, that it must be extremely laborious and infinitely tedious. Indeed, it is certain, that even the smallest compartment of the figure must be worked on the principle on which we work an entire web—that the weft must be turned at each margin of the compartment, though it should be but a tenth of an inch in breadth. The best idea we can form of the process may be derived from the mode of laying in the figures of tapestry; and hence, too, the Indian mode of working enables them to sink the ground of the web more completely, and to exhibit the colours of the pattern in a more unmixed state than we possibly can. It is remarkable, too, that long practice has taught them to combine their colours with singular harmony, and to diversify their designs, without falling into extravagance or incongruity, to such a degree, that the British manufacturer, with all his skill, finds it the best policy to copy their patterns, because he can seldom invent any thing better himself. In the execution of the figures, however, our manufacturers have made great progress within the last ten years; and this is not now the department in which their work has been felt to be most deficient. Latterly their leading object has been to rival the Indians in the fabric or basis of the web. Organzine silk was the material originally employed for warp, and upon this a weft of wool and silk, or of various mixtures of the two substances, was thrown in. This was succeeded, about 1804 or 1805, by spun silk, that is, the waste of Indian silk chopped into short lengths, and worked upon the same principle as wool or cotton—a process long kept secret, but now well known. It was made to resemble the Indian yarn very closely, and was deservedly considered a great improvement, though it still wanted the best properties of fine wool. Some years afterwards another step was made towards the introduction of the proper material, by preparing a weft of silk and Merino wool, which received the name of Persian yarn. This still continues partially in use. At length, about three years ago, an attempt was made to make the fabric of wool entirely. To the substance employed, the name of Van Diemen's Land, or Indian, or Thibet wool, was given, though in reality it consisted merely of picked quantities taken from picked Saxon or English fleeces. Of this a fabric was

made which surpassed those previously used, but it was still deficient in the exquisite softness and warmth which the Indian wool possesses, and what was not of less importance, no figure could be worked in upon it with accuracy and beauty. British enterprise, however, is not easily discouraged. Inquiries were set on foot in the East; and specimens of the actual material used in the fabrication of the very finest shawls were brought home. It was found to consist of the undergrowth of wool of the Thibet goat, or the down growing beneath the long rough hairs which form the exterior covering of the animal. It was found, too, that the article, though very expensive, could be procured in considerable quantities. But a new difficulty presented itself—this down was so extremely tender, that the most expert spinners in England despaired of forming it into a thread of sufficient tenacity to bear the operation of the loom. The practical skill and invention of our artisans is, however, inexhaustible; and we verily believe, that if it were required to convert spiders' webs into cables, they would find means to accomplish it. An English spinner discovered a process by which he was able to form a very delicate yet firm and durable thread out of this soft material, and, according to custom, he secured his invention by a patent. Some farther difficulties remained, but not of very great magnitude. Our manufacturers had some advantages before, which the natives of the East wanted; and having now the material in their hands which gave the others their chief superiority, they were in a condition to unite every possible excellence in their workmanship. We think we may safely say that this has been attained. We have seen shawls of the new fabric made by our townsmen, Gibb and M'Donald (who hold the first rank, we believe, in this branch of manufacture), quite admirable in point of softness, delicacy of texture, and vividness of colour, and which, we have been assured by adequate judges, rival the India shawls in these, and indeed in all the leading qualities for which the latter are prized. Some superiority the Indians have still in their patterns, from the tedious process they employ; but this will be confined to shawls of the very first class. In the others we already equal or surpass them, and future improvements will probably leave us little to desire on this head. To those who know how much our manufactures contribute to our national wealth, we need scarcely say, that the successful establishment of a branch of industry like this is really an object of national importance. India muslins have been already superseded by the skill of our artisans; and it is probable that India shawls are destined soon to share the same fate. Custom may keep up the old predilection for a time; but self-interest will teach people to save the two or three hundred pounds paid for an India shawl, when they can have one for ten, twenty, or thirty, so closely resembling the other in fabric and appearance, that only the practised eye of the dealer can detect the difference. Thirty years ago there was not a single shawl made in Edinburgh, and the number made in Britain was absolutely trifling. At this day, shawls are made to the value of a million sterling annually at least, and the manufacture now forms a leading branch of our national industry.—*The Scotsman.*

AN IMPORTANT INVENTION FOR INSTANTANEOUSLY RELEASING THE HORSE FROM A CARRIAGE, IN CASE OF ACCIDENT.

Sir,—Your constant readiness to give a place in your highly useful Magazine to whatever appears of advantage to the public, induces me to send you the accompanying, for the favour of an early insertion.

The many fatal accidents which have happened with those very convenient and economical little carriages, low phaetons, from the horses taking fright, or, from other causes, running away with them, by which several individuals, particularly females, have lost their lives, from their clothes catching in the wheels

or other parts of the carriage, in endeavouring to jump from it, or in being thrown out (as was the case with the lady who was killed in the Regent's Park, by the horse being affrighted and running away with the carriage at the sudden report of one of Mr. Perkins's steam-guns); I have, in consequence of such accidents, and their frequent liability of occurrence, lately adopted a most simple and perfect mode of instantly releasing the horse from the carriage, on the animal's becoming in the least restive or unmanageable, or attempting to run away.*

The common description of harness answers, with a slight alteration in the traces, and connecting straps to receive the iron-work that confines it to the shafts, from which, by a momentary action, it is released, by pulling the safety reins attached to the draught-pin, which it instantly removes, and disengages every part of the harness from the carriage; at the same time suspending the shafts to the vehicle, to guide it while it continues in motion, or to check it, as may be found necessary.

The next great advantage which belongs to the invention—the first being that of preserving the vehicle and the persons in it from the least injury by the release of the horse—is, that the shafts being detached from the animal, and no part of the carriage remaining fastened to the harness, which is likewise confined, so that no strap or part hangs loose, there is consequently nothing to strike against, or excite the violence of the horse, or to cause an injury to him, which would otherwise be the case, if the shafts or any other part remained attached to the animal, as in former inventions of this nature.

The whole of the release apparatus is of the most simple description, and its price so moderate, that it bears no comparison to its great utility, and the important advantages which it is found to possess, by the many individuals who have it now in constant use in different parts of the kingdom.

Any person wishing to have a phaeton constructed on the safety release principle, may be furnished with every information concerning it, by applying for the inventor's card of address, at No. 25, Bow-street, Long Acre.

I remain, Sir,

Your obliged servant,

G. M.

* "On Tuesday, as some ladies were driving out for an airing in a four-wheeled chaise, the horse took fright near Ware, and ran away, when one of them, Miss Waller, of Jenningsbury, became so alarmed, that she leaped out; her clothes caught in the wheel, which went over her leg, and fractured it in so dreadful a manner, that it is feared amputation will be necessary; and what renders the accident still more melancholy, is, that her shoulder was dislocated at the same time. The horse continued his course, and was only stopped by coming in contact with a post at Hoddesdon, by which shock the other ladies were thrown out."—*Morning Paper, Aug. 25th.*

INCREASING STRENGTH OF GUNPOWDER.

Sir,—Having yesterday purchased the first volume of your Mechanics' Magazine, a work I never had the pleasure of seeing before, I found, on looking over the index, "Pasley on increasing the Strength of Gunpowder, p. 317." "How fortunate!" I exclaimed—"the very thing to discover which I travelled to the Gun-proof Depôt, Birmingham, this time last year, and came back disappointed!" I ript the leaves open, *sans cérémonie*, gazed with avidity, and saw—What?—Yes, the identical section of a cannon which—No! it could not be the same section. "Then I'll swear (said I) its interior form is a very copy of the section my brother, James Walkinshaw, showed me in the month of December, 1811, when, after an absence of ten years, during which time he had been in the service of the British navy, he came, on leave, to pay me a short visit at Coleford."

It is foreign to my purpose to enter at large into the merits of this cannon; suffice it to say, on discovering

that a large portion of the powder used by heavy ordnance was actually thrown out unignited, and consequently useless, by the sudden explosion of that behind it, he had been led, by much reflection, deep study, and analogical reasoning, to invent a cannon, to obviate the imperfections he saw in those in common use, and effect a great public saving of that (more especially at that time) very important article. He suggested, therefore, to confine nearly the whole requisite quantity of powder in a spherical chamber within the breach of the gun, and communicating with the main calibre by a narrow bore, only half the diameter, or one quarter of the area of the said calibre; judging that the concentrated form of *most* of the powder within this sphere would have a tendency to more simultaneous ignition, and the partial confinement afforded by the small bore would increase the effect of explosion, with even a smaller quantity.

How far his reasoning is correct, I pretend not to say, though I confess to have been very sanguine of its merits at that time; my rising hopes, however, suffered some depression, when he informed me of his having applied to several officers of distinction, who all agreed that no new scheme would succeed that did not originate with the Board, or had the support of great capital or great interest.

It would be trespassing on your forbearance to say more, but the curious coincidence of two people hitting on the same thing so exactly, roused my dormant feelings—not more alive to my brother's merits than to a love of justice—to claim for him the priority of invention.

If any proof were wanting of the certainty of my narrative, it may be had by producing a small cast-iron cannon which he made at that time, boring it out of the solid by the help of a foot-lathe, and tools of his own making; but what I thought the most curious thing, was boring out the interior spherical chamber. When finished, he presented it to the sons of a gentleman at Coleford, of high scientific attainments, where it may still be seen.

As the contrivance for boring out the said chamber may be usefully applied to other purposes, I should thank some of your ingenious readers to favour the public with a sketch and description of such a one, in order to ascertain if a similar coincidence of thought should be developed in this, as in the subject of this letter. In the mean time,

I remain, Sir,

Your most obedient servant,

J. Walkinshaw.

P.S. As I am concerned with the blasting of rocks, &c. and anxious to discover the most economical method of using gunpowder, I should be glad of information from some of your readers, whose suggestions, if reasonable, shall be put in practice, to ascertain their respective merits.

IMPROVEMENT ON SHOEMAKERS' SIZE-STICKS.

Sir,—The Shoemakers' Size-stick, as at present constructed, is useless for taking measure in inches, as the fixed guage is placed about a quarter of an inch within the beginning of the first inch of the scale of inches, and thereby the guages only describe the length of the *foot*, or *last*, in sizes; whereas, by the simple alteration of making *both* scales commence at the same point (the inner edge of the end guage), the size-stick would give the measure both in *inches* and sizes, and the ruler would then answer as callipers for general purposes, as well as a size-stick for shoemakers.

The improvement is so obvious and easy, that the manufacturers will doubtless adopt it, if pointed out in your useful miscellany.

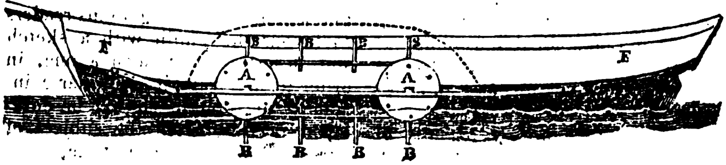
I am, Sir,

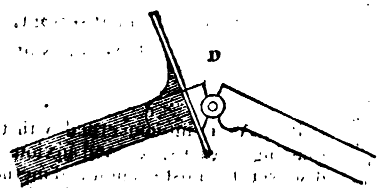
Your humble servant,

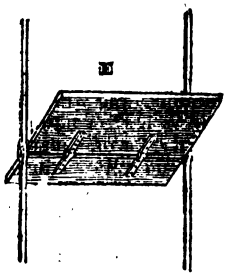
R——.

Aberdeen.

IMPROVED STEAM-BOAT PADDLES.







SIR,—It has been remarked in your valuable and widely-extended Magazine, that if every man would contribute his ideas as they arise, in the course either of his employment or his leisure, it would be the means of general improvement. In compliance with this invitation, I lay before you the above sketch of an improvement in the Paddles of a Steam-boat.

In the present paddles there is much power lost, as, of the three paddles in the water, there is but one that acts with full power at one time; for the disengaging of the last counteracts the first; and, again, when the vessel is head to wind, in consequence of the great height of the wheel, the resistance is much greater than according to the plan I have now to propose.

Description of the Sketch.

AA are two octagons, or a circle reduced to a greater number of sides, placed at a certain distance on the side of the vessel, according to the number of sides; the foremost to act from the power of the engine, the after one to act in unison with and from the power of the foremost.

BBBBBBBB are the fan or paddles.

C is the stay for the outside of the work.

D is one link of the bolt-chain, with a rule-joint to keep it stiff when straight, and to permit it to pass over the side of the wheel when in motion.

E is the fan or paddle, as fixed in the chain.

F is the side of the vessel.

The wheel, fan, and chain, are similar to a chain-pump; the chief difference consists in square fans instead of round buckets.

The dotted line shows the height of the case above the whole.

I remain, Sir,

Your obedient servant,

W — G x.

S.........ton.

MR. H. MATTHEWS'S IMPROVED SAFETY GIG.

Sir,—In Number 104 of your valuable work, I perceive an excellent invention of Mr. H. Matthews, for counteracting the danger to which many are, and ever must be exposed (in the present construction of gigs), occasioned by the horse falling, or even stumbling; both which circumstances more particularly occur in going down hill, which, for many reasons, often renders the accident of a very serious nature. Now, Sir, I am one of those "thinking persons," who, as Mr. M. observes, would "doubtless adopt his plan." But it appears to me, that the beauty of his vehicle might yet be improved, not by an alteration in the principle, but merely, in the first place, by building the gig lower, to agree with the fashion of the times; and secondly, by causing the step to reach as near the ground as possible, which would render the safety-irons less perceptible. No doubt, many who use fashionable gigs would at once condemn Mr. M.'s plan, as offensive to the eye; but if a vehicle were constructed, according in every respect with the gig of the present day (except when the safety-irons intervened), even those very individuals who so much regard outward appearance, and set safety in the background, would probably second Mr. M. in his opinion, and eventually "adopt his plan." He must be aware, however, that some gentlemen would object to his plan, as it would appear that they were driving a horse that was not able to keep on his legs. But though some will risk their neck, rather than beforehand attempt to save it, let "thinking persons" put up with the singularity of having two or three extra pounds of iron attached to their gig, as, one day or other, this very extra metal may possibly be of infinite value, though it be merely iron.

I am, Sir,

Your most obedient servant,

S. R. C.

PRINTER'S SHEET-COUNTER.

Sir,—Your Correspondent, "T. C—n," of Derby (p. 345, vol. iv.), may obtain such information as he requires, on referring to Gregory's Dictionary of Arts and Sciences, article 'Pedometer.' Stuart, in his very interesting History of the Steam Engine, page 124, mentions an apparatus of this sort being used by the celebrated Watt to tell the number of strokes made by his engines. Such an apparatus in a printing-office would, no doubt, be very useful; and as one to count as high as ten thousand need not cost more than twenty or five-and-twenty shillings, we may expect soon to see them in general use. If T. C—n is a printer, and will tell us so, he shall be supplied.

I remain, Sir,

Yours sincerely,

Henry Russell.

London, September 5th, 1825.

CHINESE METHOD OF WARMING HOUSES.

Sir,—As the Chinese method of warming their houses appears applicable to our green-houses, and, perhaps, the room of the artisan, with a little improvement, I beg the insertion of this account of it in your very valuable Magazine.

In building a house, they make two stove-holes, one in each side-wall, about three feet from the gable end. The holes are a foot square; one serves for receiving the fuel, and the other to let out the smoke, when the stove is finished. There is a partition of brick, which runs from one side of the house to the other, about five or six feet from the gable, and only eighteen inches high, which may be called the front of the stove-bench. Between this and the gable are built several other thin partitions of brick, in a direction at right angles to the first, having a small opening at the extremity of each. For example, suppose the passage in the first partition to the right hand, and

in the second to the left, and so on, alternately, to the last, which communicates with the hole on the other side of the room, for letting out the smoke. These divisions being made, the whole is arched, or otherwise covered with brick, above which is laid a layer of clay or plaster, to prevent the smoke from rising through the surface. It is plain that, below this bench, there will be a winding channel for the smoke, from one side of the room to the other. A few handfuls of brushwood, straw, or any kind of fuel, will warm the bench as much as is necessary to work or sleep without feeling cold. It is generally covered with mats, felts, or other thick stuffs, according to the ability of the owner.

I am, Sir,

Your obedient servant,

* * * * * *.

MACHINE FOR LOWERING COFFINS.

Sir,—The draft of the Machine to lower Coffins (No. 105) is incorrect. As the wheel and three nuts are at present placed, not one of them can turn—the nut, H, should not meet the wheel, F, but better without the great wheel. Suppose the nut, I, was on the cross-piece, and parallel with the nuts G and H, then a small wheel in the same parallel line would do the business. The three nuts and wheel may be all of one size, say nine inches diameter, which would leave 27 inches for the width of the frame; the use of the wheel between the nuts is merely to give a contrary motion to the two rollers, A and B. If the nuts, H and G, are of the same number of teeth, the motion of the rollers will be uniform, whatever may be the number of teeth on the nut, I, or the wheel, F; for wheels working tooth to tooth neither accelerate nor retard motion.

I am, Sir,

Yours respectfully,

R— H—.

GAS-LIGHT PIPES.

Sir,—I would, agreeably to your motto, communicate (if you have a few inches to spare) something that has come under my observation when employed in the gas-fitting way, and when practically employed in that department twelve months ago in London.

Having been called to rectify a gas light that would not burn, in the house of Mr. More, Serle's coffee-house, Carey-street, I commenced pulling down the pipe leading to the light, and found that it was very much corroded with, as I thought, the common dry sort of incrustation that adheres to the sides of the pipe. I pursued the usual means of cleaning it, which is with common iron wire, annealed, drove through it, and, to my astonishment, on my applying the wire to the inside of the pipe, and driving it up and down, the contents (the corroded matter) exploded with the report of a musket through the opposite end resting on the ground: the smell was that of gunpowder. If any of your able Correspondents can explain what the mixture could have been composed of to make it so highly explosive, merely by the friction or percussion of thin soft iron wire, I should feel much obliged for the information.

I am, Sir,

Yours respectfully,

R—— E——.

Abertawa.

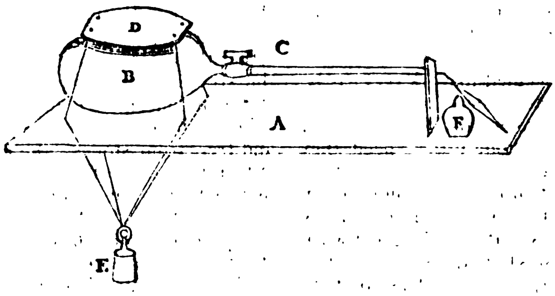
P.S. As the situation of the pipe makes a material difference in the nature of the deposit, I would wish you to understand that the gas light was in the street lantern above Mr. More's entrance, the pipe half-inch copper, running along the iron ornament of the lantern support; likewise the small stop-cock, belonging to the light inside the lantern, *was always kept open*; the light was, like four others, put out by the main-cock; therefore the pipe that is occupied at night by carburetted hydrogen is, in the like way, full of

atmospheric air in the day-time, in consequence of the small lantern-cock being always open; such was the case with the present one. May not this produce a very different chemical action on the inside to what it would if the air was excluded, forming some phosphorescent component, having a fulminating nature?

IMPROVED SHOT.

A patent has just been taken out for a new method of making shot. The improvement consists in mixing a small proportion of quicksilver with the lead, by which means the shot is rendered harder and heavier; and divested of the arsenic, which was one of the chief objections to the original patent shot. Other advantages are stated to be, that a shot of a smaller size is procured for guns of smaller calibre, yet equal to larger drops; that the game killed by it keeps better; that it is as clean as silver to handle, and may be carried loose in the pocket; and that it has less friction in firing.

SIMPLE BLOWPIPE.



SIR,—I send you a rough sketch and description of a Simple Blowpipe, which I find to answer extremely well. If you think it worthy of insertion in your much-admired publication, it is at your service.

I am, Sir,
A constant reader,
H. R. W.

Description of the Drawing.

A, a deal-board, of any convenient size.

B, a large bladder, to which is adapted the stop-cock and jet-pipe, C.

D, a piece of wood, with four cords attached to it (as the sketch indicates), which pass through the board, A.

E, a weight attached to the lines, which causes the piece of wood, D, to press upon the bladder, and, of course, drives the air through the jet-pipe to the spirit-lamp, F.

HAINAULT SCYTHE.

The Hainault Scythe is now undergoing the test of experiment in Scotland, and two farmers have been brought over from Flanders for that purpose. It consists of a short blade of twenty inches, or nearly like the point-half of an ordinary hay-scythe, and has a handle of the same length. The blade during cutting is quite level, both from point to heel, as well as from edge to back. The handle stands in a position nearly upright, or inclines forward at the top, so as to form, with the blade, an angle of 80 degrees. That portion of it held in the hand is turned back a little, or nearly to 45 degrees, and is longer than the breadth of the hand, on which overlength the arm rests, and is strengthened during cutting. In the left hand the operator holds a staff 3½ feet long, at the

extreme end of which is a hook; while cutting, this is used in pressing back the corn about midway up at the time the scythe strikes the bottom. At each stroke the scythe cuts the length of itself, and a foot or more deep, which cut corn it leaves standing quite upright in front of the uncut victual. As soon as the operator has proceeded as far as he wishes across the ridge, he turns, and with the hook pulls the corn towards the open side, cutting a little more at the same time, so that in going and returning three feet may be cut. The operation is exactly the mode of cutting called bagging in England, only the handle of the bagging-hook is straight with the blade, and occasions the reaper to stoop, and the baggers use the fingers in gathering, and a small rip of corn in cutting, instead of the staff and hook. There can be little difference in point of time, but the Flemings seemed to work very easily. No trial was made of the time they would take to cut any given quantity of grain, although the speed they made certainly warranted the assertion, that two in a day would cut an English acre. This is often done by the baggers. It is very good work to three sickle-reapers to do this, and bind it, as it is understood they do. The scythes used were very clumsily made and ill-tempered, and broke and bent on receiving the slightest extra opposition; but if the instrument is found beneficial, this will soon be remedied by British makers.

Farther particulars.

On Saturday, the 27th ult., the Flemish reapers exhibited the use of the Hainault scythe, on the farm of Hillhead, estate of Cardonald, belonging to Lord Blantyre, and occupied by Mr. John Hogg. Sir John Maxwell, Mr. Maxwell, Mr. Spiers of Elderslie, Mr. Campbell of Blythswood, Mr. Stewart of Williamwood, Mr. Orr of Ralston, Major Walker, Mr. Wilson, and several other gentlemen, and a number of practical farmers, were on the spot. About eleven o'clock, the reapers began to a field of wheat, of which they cut about 495 ells in 25 minutes, which produced four stooks, each containing 14 sheaves. At this rate the two reapers would have cut a Scottish acre in five hours and ten minutes. The wheat was sown about New Year's-day, the straw was strong, and the crop will probably run about ten bolls an acre. Mr. Hogg was aware that the reapers were to exhibit on that field, and when he set the shearers to cut down the other parts that were ripe, he enjoined them to take time, make the stubble short, and finish their work in a neat and masterly manner; "so that the kintra might na be affronted a'thegither wi' the strangers." He was more than once complimented on the neatness with which the field was cut, yet, notwithstanding, the part cut by the Flemings is quite apparent in the shortness of the stubble. Except on some solitary parts, that had been cut with either the point or heel of the scythe, the stubble runs from two to three inches in length. On the tops of the ridges, where the ground was smooth and free from stones, the crop was cut quite close to the ground. It is believed that an ordinary crop of wheat, cut by the Hainault scythe, will produce from 16 to 20 stones of straw more an acre, than when cut in the usual way. The exhibition on the wheat-field gave great satisfaction to all present. The Flemings next proceeded to a field of oats. On this field, before sowing, lime had been harrowed in, and a number of unburnt lime-stones were lying on the surface. The crop was estimated at nine bolls an acre. They cut 308 square ells, which produced four stooks, each containing 12 sheaves, in about the same time they took to the wheat. Though the field was very unfavourable for the scythe, the stubble was visibly shorter than that of the oats cut with the hook. The implements must have been considerably injured on this trial, as they had driven pieces out of a number of the stones that were lying on the ground. The Flemings had most trouble with some spots where the crop was very thin, and the ridge sloping into the furrow; but still they managed it better, in respect

of stubble, than could be done with the hook. When the crop is light, it does not stand the stroke of the implement so well, and they cannot get forward with the same expedition as when it is heavy, and the ground level. They next cut a small quantity of barley, to show that the scythe was as well adapted for cutting it as any other sort of grain. The ground in this case was not measured, and no attention was paid to the quantity cut. The next trial was in a field of beans, and here the scythe was shown to great advantage. The crop was very good. The ground was quite level, free of stones, and every thing was favourable for the trial. They cut 161 square ells, which produced 33 sheaves. In this case the difference of the stubble is very striking. Grass, weeds of every description, as well as the crop, were swept away by the scythe, and there is scarcely a green blade to be seen on the spot where the trial was made. The gentlemen were highly satisfied with the exhibition in this field, and declared that the superiority of the scythe, for heavy crops, was beyond the reach of controversy.

After the Flemish reapers had finished their business, a very ingenious scythe was shown by Mr. Kippie. With this implement the inventor cut both oats and barley; and the gentlemen who witnessed the work expressed great satisfaction with it. This machine is the common scythe, with the addition of a tin back and spring in front, which regulate the cutting, and collect the corn into neat rows. Mr. Kippie computes, that nearly as much corn could be cut with it in a day, as of hay by the common scythe. It is much to be wished that an opportunity was afforded to Mr. Kippie of exhibiting the merit of the instrument in a larger trial.

EXQUISITE MECHANISM.

A watchmaker of Bayreuth has manufactured a cage filled with birds, to the number of sixty, representing parrots, sparrows, swallows, &c., each of which has the peculiar note given by Nature. The cage is made of brass, and the wheels which make them move and produce the sound are of silver; the plumage is real. A person of distinction, it appears, offered the watchmaker 32,000 florins for his cage, but he will not take less than 60,000.

INQUIRIES.

NO. 147.—UNIFORMITY IN COLOUR OF BRICKS.

Sir,—If any of your Correspondents would, through your useful Magazine, furnish me with information on the following subject, they would confer a great obligation.

I have a brick-kiln now in constant use, the bricks made are good, but scarcely two of the same colour; out of the same kiln are pale yellow, deep yellow, bluish red, pale red, and brown, with all the intermediate shades of colour. Coal is used in the burning, and the soil is a bluish marl; the lime frequently bursts the bricks, and shows itself in the tiles in small spots. I wish to be informed how the bricks may be made nearly of the same yellow colour? and also how to colour the tiles of a slate or dark colour?

I am, Sir,
Your obedient servant,
A Brickmaker.

NO. 148. — PERMANENT COVERING FOR STACKS OF CORN.

Sir,—I hope I am not improperly trespassing upon your most useful Magazine, by requesting information from some of your Correspondents on the following subject:—

Having for the last two years (*in particular*) sustained considerable loss by rain having injured my stacks of corn before they could be covered, and considering, also,

the annual heavy expense in thatching, I wish to be informed if a *permanent* cover cannot be made at a moderate expense, something in the following manner?

A wall being first built, of about two feet six inches, on which the stack rests, with a coping to keep out vermin, an iron pillar may rest upon each corner covering, and lashing over two bricks, each way, to steady it; from them a very slight deal roof may be built, resting upon a larger tube in the centre of the stack, which should be hollow, and pierced with holes to let out the heated air. The cover may, I think, be brown paper, well tarred, resting on strings, or on a light net drawn over the whole. I should think that the iron corner pillars may be made in pieces of about three or four feet long, fitting into each other either by screw or otherwise. I wish to be informed of the expense of the cast-iron pillars, and what size they should be made of, and any improvement in the form or plan which may suggest itself to your Correspondents.

I must remark, that the expense of thatching a moderate-sized stack, taking in all the work necessary, cannot now be less than one pound, and, what is still worse than the expense, is, that the work *must* be done at a time when all hands are fully employed in harvest. Wishing success to your useful undertaking,

I am, Sir,

Your obedient servant,

NO MECHANIC.

NO. 149.—ECHOES.

SIR,—I shall feel much obliged if any of your numerous Correspondents will inform me which is the best and cheapest way to remove an echo from a room or chapel?

I remain, Sir,

Most respectfully yours,

SIRROM.

ANSWERS TO INQUIRIES.

CALCULATING THICKNESS OF METAL PLATES.

[*Page* 256, *Volume IV.*]

SIR,—Your Correspondent, who signs B. C., in Number 100, asks for a short rule to find the thickness of a thin plate of metal, whose weight, area, and specific gravity, are known.

Let A = area of surface,

W = weight,

T = thickness,

S = specific gravity,

$\therefore$ A . T = magnitude of mass,

and S . A . T = weight of mass = W.

$\therefore T = \frac{W}{A \,.\, S} = \frac{W}{\pi \,.\, \gamma^2 \,.\, S}$, if the plate is a circle whose radius is $= \gamma$; π being the circumference of a circle whose radius = 1.

I remain, Sir,

Your obedient servant,

F. O. M.

Nottingham, August 12th, 1825.

P.S. To reduce the first formula to words, in order to find the thickness of the plate, divide its weight by the specific gravity multiplied into the area, and the quotient is the thickness required.

NO. 133.—MANAGEMENT OF BEES.

SIR,—In reply to an inquiry in No. 96 of your Magazine, for the best mode of sheltering flat-top Bee-hives, I inform your Correspondent from Burton, of a cement sometimes made use of in France, which I think well calculated to answer his purpose; I have used it generally to secure my hives to the board on which they are placed, and prefer it to any other in which lime is an ingredient, because it does not crack, and give admission to other insects. I have covered my hives totally with it, and they have borne exposure to all kinds of weather for many months, but, having observed the straw, of which my hives are formed, became injured by the confinement

of the moisture which arises from the bees themselves, have discontinued the use of it to my round-top hives, and only cover the boarded top of my flat hives with it, for the sake of warmth during winter.

I first put a piece of linen or calico over the board, and plaster the cement upon it half an inch in thickness: the use of the linen is, that the whole may be easily separated at once from the cover, whenever a glass or other hive is required to be added above.

My flat hives are always placed under a boarded house or shed, and my stands are entirely unconnected with each other. A large garden flower-pot, whose sides are more upright than those usually made, forms a good stand for each hive; the upper edge should be perfectly level, and the interior filled with sand, with a small quantity of oak sawdust or salt sprinkled over it, to exclude insects. No mice can climb the sides of this stand, and its being moveable adds much to its convenience.

The cement I have spoken of is composed of two-thirds of fresh cow-dung, and one of sifted wood-ashes, which, if placed in a wheel-barrow, may be quickly beaten into a uniform mass, and, being put into some covered vessel, will keep many months ready for use. For common purposes, the fresh cow-dung collected from the fields may be used; but if the cement is to be exposed to the weather, that collected from cows or oxen fed in stalls, on dry food, is preferable, it being more tenacious.

I am, Sir,

Yours faithfully,

JOHN DUNCOMBE.

Dunmow, Essex.

CORRESPONDENCE.

A Correspondent, "desirous of promoting the arts, &c. suggests the propriety of using Plates of Zinc for the casing of such Mill-stones as are used for grinding wheat, and will thank any of our Correspondents to inform the public, through our medium, where such plates as are proper for that purpose may be procured—say, of about 1-12th of an inch thick, 16 inches broad, and 4, 5, or 6 feet long."

The Newspapers make mention of a Time-piece, brought to perfection by a Gentleman at Cambridge, composed only of one wheel and a lever, and put in motion by a chemical process. An old Correspondent would be obliged to any of our Correspondents for a description of it.

Chemico-Mechanicus thinks, that the ingenious contrivance for throwing a self-regulated stream of hydrogen gas upon spongy platina, of which a draught and description are given in one of our Numbers, might be applied to the putting in motion a time-piece.

H. N. says, that "perhaps P. L. M. (No. 104) will find Simpson's Treatise on Fluxions, lately re-edited, in two vols. 8vo., by a Graduate of Cambridge, the best suited to his purpose." "P. L. M." he adds, "is no doubt aware, that at least a general acquaintance with the pure and several branches of mixed mathematics is a necessary pre-requisite; such as the first six books of Euclid, the working of Algebraic Equations, Conic Sections, and Mechanics. With those preparations he will no doubt be able to follow the author, generally speaking; but he must not be deterred if occasionally he encounter difficulties, which can only be removed by reference to some one more advanced in the science."

Communications have been received from—Aquarius—W. C.—Mr. Dickenson—G. N——d—T. E. B.—Montis, Jun.—Amicus Veritatis—A. Z.—Inventor—C. T.—P.—Mr. Ogle—Humanitas—J. B. G. U. A.—Cæsar Borgia—W. B.—A. S.

*** Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th of each month.

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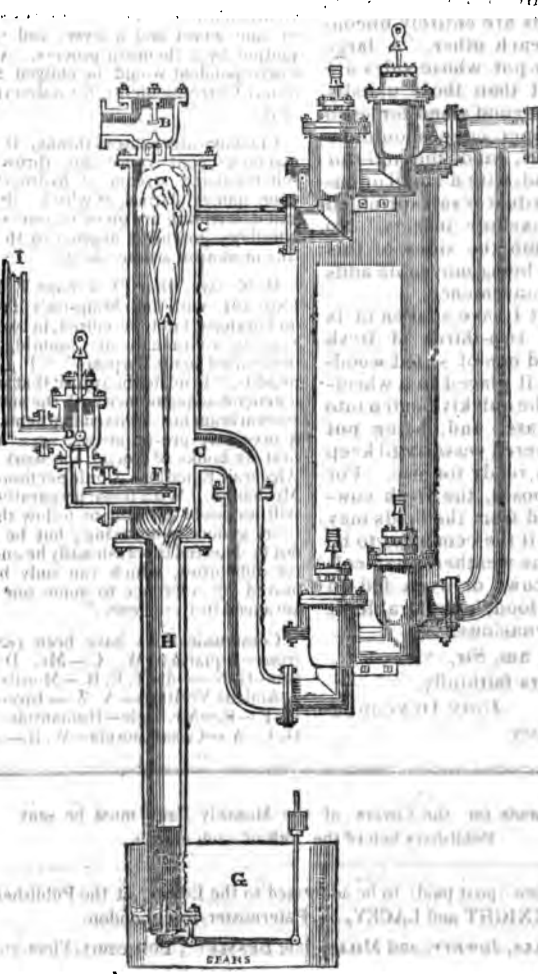
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 108.] SATURDAY, SEPTEMBER 17, 1825. [Price 3d.

IMPROVEMENT ON THE HIGH PRESSURE STEAM-ENGINE,

BY MR. JOHN PATTISON.



IMPROVEMENT ON THE HIGH PRESSURE STEAM-ENGINE.

BY MR. JOHN PATTISON.

[*To the Editor of the Mechanics' Magazine.*]

The Steam-Engine, in its present various and modified applications, is connected with so very large and important a part of the wealth and commerce of our country, that any attempt to render it more simple in its construction, or more effectual in its operations, can need no other apology than its proportionate consequence to the wants and happiness of mankind.

My business of life, hitherto, has been the erection and management of steam-engines, as they are used by the coal trade in the neighbourhood of Newcastle, where the Trevithick or high pressure engine has been lately introduced at several of the collieries, for the purposes of pumping water and drawing coals. Some of those engines, so applied, have been under my management for some time, during which it has frequently occurred to me, that, instead of discharging the steam into the atmosphere, a considerable increase of power might be gained by opening the discharging valves into a close vessel, and throwing in at the same time a jet of cold water, so as to produce, to a certain extent, a vacuum, which, of course, would so far assist the alternate sides of the piston, and be a proportionate real increase of power. Undoubtedly the difficulty of getting quit of the air generated by condensation, without the use of an air-pump, presented itself, and to some of my friends, to whom I mentioned the subject, seemed an insurmountable obstacle; but some experiments which I had made on what is termed high pressed steam, together with my observations of the way in which the common atmospheric engine clears the cylinder of air, confirmed me that my idea was practicable, and, to a certain extent, beneficial. With this opinion I mentioned the subject to Mr. Buddle, who thought it was at least worth trying, and with his usual liberality, and that constant encouragement which he always affords to the improvement of science, requested me to make an experiment, the latter end of last year, on the pumping engine at Elswick Colliery. The cylinder of this engine is 31½ inches diameter, the piston making seven 8 feet strokes per minute, and delivering at each stroke 64 gallons from a depth of 55 fathoms. Previous to making this experiment, the safety valves on the boiler were loaded at 34.7 pounds per inch, and the boiler consuming 69 cwt. of coals in eight hours and a half. After I completed and set to work the condenser, and attached a pump from the hot well to feed the boiler (the engine going at the same rate, and performing the like quantity of work in the same time), the pressure on the boiler was reduced to 27 pounds per inch, and consuming only 41¼ cwt. of coals in the eight hours and a half. Nothing could be more satisfactory than this result, and, to prove the nature and extent of the vacuum, I attached a mercurial barometer to the condenser, and found it sustained a column of mercury upon an average of 14 inches altitude, its greatest height being about 22 inches.

Since carrying this into effect, I have attached a double condenser to a machine for drawing coals, which is bringing to bank five score carves or baskets in an hour, from a depth of 66 fathoms, drawing two at a time. The result of this is equally satisfactory with the other, in having fully as much lessened the pressure per inch on the boilers, and considerably diminished the consumption of coals.

I have prefixed a drawing of a single condenser, as attached to a pumping engine.

To those who are acquainted with the action of a Bolton and Watt's engine, any description beyond a reference will be unnecessary, and,

as the condensing part is so exceedingly simple, it will need little explanation even to those who have not attended to this part of the steam-engine. Like Mr. Watt's condenser, this one requires blowing through previous to starting; but, in order to produce here the *maximum* effect, the injection must be so regulated as not to cool the condenser below the temperature at which the shifting valve will be lifted once every double stroke. In the pumping engine above-mentioned, the quantity of cold water used for condensing each alternate stroke is 2.75 gallons, from a jack-head cistern 22 feet above the condenser. The upper discharging valve, and the one for the injection, are both lifted at the same time, but the bottom discharging valve is opened into the condenser a little before the injection, which, of course, lifts the shifting valve, expelling the air previously contained, at the same instant the injection is thrown in, when a vacuum is produced of not less than 22 inches of mercury.

It will easily be seen that the injection water, together with the condensed steam, pass down the sink pipe, and are discharged at the foot valve at the same time the air is expelled. This valve is kept in its seat by a weight and lever, which is nearly equipoised, and which readily admits the discharge of the water into the hot well.

From what I have stated it will, perhaps, be objected by some, that the vacuum is not constant and uniform; this, indeed, must necessarily be the case from the manner in which the air is expelled from the condenser, but, as far as regards its action on the engine, it is not productive of the least irregularity, but, on the contrary, is a real and permanent increase of power, on the lowest estimation, of seven pounds per inch, and that too without the drawback of any additional machinery beyond raising the injection water and lifting the valve.

I trust it will be fully understood that I am not claiming any new invention, but only a method of applying, to the high pressure engine, the plan of condensation used in the old atmospheric engine, but performed in a vessel distinct from the cylinder, and this is, as far as I am acquainted, a new application. If it is adopted, and found as beneficial in any other situation as I have proved it here, my object in making it public is at once fully attained.

JOHN PATTISON.

Elswick Colliery,
near Newcastle on Tyne.

Description of the Plate.

A, condenser.

B, shifting valve, the lid of which is as light as possible.

CC, discharging steam pipes.

D, injection valve.

E, foot or discharging valve.

F, injection cap.

G, hot well, from which the boilers are supplied.

H, sink pipe.

I, injection pipe.

SPHERICAL CHAMBER CANNON.

SIR,—In your last Number, Mr. J. Walkinshaw appears to claim, for his brother, the invention of the Spherical Chamber Cannon. I beg leave to refer him to the following extracts from Le Blond's *Eléments de Guerre*, by which he will perceive that the assumed discovery is nothing new and nothing worth.

I remain, Sir,
Your most obedient servant,
W. H. PITCHER.

Charlotte-street,
September 12th, 1825.

"*Artillery, Chap. II. Section 8th.*

"It is evident that the greater the quantity of powder which takes fire at the same instant, the greater its effect will be upon the ball. This gave rise, towards the end of the last

century (the 17th), to a new construction of the bore of cannon, by making a cavity, in the form of a sphere, a little flatted," &c.

"The design of this contrivance was to throw a bullet from a piece, shorter, lighter, and more easy of carriage than others, with the same degree of force as from those before used. Experience proved that the construction of these pieces answered the *end proposed*," &c.

"But, as it was difficult to clean the chamber after the piece had been fired, there frequently remained some sparks behind, so that, when it was necessary to fire the pieces as fast as possible, many cannoneers had their arms blown off as they were charging them; and, besides, as the powder, before it forced itself out of the chamber, pressed on all sides with such violence and impetuosity, in a very little time the carriages were broken to pieces and rendered unserviceable; also, by a frequent repetition of this violent agitation, the piece acquired a very considerable recoil, and the direction of the ball became uncertain. For these reasons this contrivance was entirely laid aside," &c.

LONDON MECHANICS' INSTITUTION.

On Wednesday, the 7th inst. the seventh Quarterly Meeting of this Institution was held at their Theatre in Southampton-buildings; the President, Dr. Birkbeck, in the Chair. A Report of the Committee of Management was read, from which it appeared, that the progress of the Institution has been such as to exceed the most sanguine expectations of its friends and supporters. Five hundred and twenty-five new members were added during the last quarter, making the whole number at present 1483. A considerable number of the members receive instruction in the schools of arithmetic, mathematics, drawing, and French, and their great attention has been amply rewarded by a rapid progress towards proficiency. The philosophical and mechanical apparatus has been greatly increased, and the library so extended by liberal donations and extensive purchases, that in the course of the ensuing month the Committee will be able to establish a circulating library for the use of all the members. The Report concluded by congratulating the members on the bright prospect of the realization of the highest hopes they could have formed of the success of the Institution, and on the zeal, activity, and harmony, by which all their proceedings were characterized. Mr. Cope, Secretary of the Building Committee, read a Report, by which it appeared that the theatre cost 3700*l*., the whole of which was advanced by Dr. Birkbeck, and that 1170*l*. had been expended on other buildings and improvements. One of the auditors read a Report of the state of the accounts of the Institution, by which it appeared that their finances are in a most flourishing condition, there being a balance of upwards of 1000*l*. in their banker's hands. All the Reports were agreed to. Thanks were voted to all the officers of the Institution. On thanks being voted to Dr. Birkbeck, which was followed with the greatest applause, that gentleman, in making his acknowledgments, observed, that the example of the London Mechanics' Institution had excited such a desire for a participation in the blessings it was calculated to impart, all over the country, that the most gratifying accounts were constantly receiving of the formation of new Institutions; and it must be delightful to every friend of human improvement and happiness to find, that their establishment was uniformly attended with increased order in conduct, and respectability in character; confirming in every respect the opinion formed, by those who had assisted in the establishment of the London Institution, of their important results and extensive utility.—*Circular to the Newspapers.*

We have received an account somewhat different from the pre-

ceding from one of the members of the Institution; but the individuals who manage its concerns are so apt to take up in a hostile spirit every exception taken to their proceedings, no matter how honest or well-intentioned, that, for the sake of avoiding controversy, we must pass over many things in his letter that would surely lead to it, and confine ourselves to an extract or two, which seems to us to admit of no question.

"A vote of thanks," says our Correspondent, "to the Lecturers, did not appear to be among the resolutions prepared for the adoption of the meeting; and on an officious member's proposing to supply the omission, a retiring member of the Committee replied, 'that the Lecturers *now stood upon a different footing to what they formerly did'*—meaning thereby, as we all understood, that they are now *paid* for their services. I was rejoiced to learn this, and thought, at the time, how much pleasure it would give you, Sir, to find, that a point for which you contended so strenuously, has been conceded at last. I must confess, however, that I was, and am, at a loss to perceive why the *paying* of the Lecturers should so entirely deprive them of a claim to our thanks."

"The Report spoke of the prosperous state of our finances, and of our highest hopes having been realized; while, at the same time, it was confessed that we are 3700*l.* in debt to Dr. Birkbeck (beside a large debt of gratitude), and that the number of lectures is reduced from two or three to one a week. Precious prosperity this! Bright realities, indeed! But for the Elementary Schools, which are excellent, and the Library, the benefits we have to boast of would be but few."

"It is not to be denied, Sir, that the Institution, on the whole, is doing better than it did; but it would be more consistent with candour and fair dealing to say less of the past, and take credit for the present only."

OBJECTIONS TO MR. J. BUTTERS' TELEGRAPH.

1st. The expense and difficulty of putting down the pipe.

2ndly. The utter impossibility of finding the defective part in case of a leak, and the total interruption of a communication.

3rdly. The difficulty of adjusting the indices in the first instance.

4thly. I think that, perhaps, the great distance of one index from, and the proximity of the other to the pump, would admit of great difference in the density of the air at the two places, and thus one index would show one thing and the other something quite different, to say nothing of the difference of temperature at the two places, and thus wrong orders would be given and endless confusion arise. Mr. Butters sets out with a wrong supposition, viz. that Portsmouth and London are on the same level.

I remain, Sir,
Your obedient servant,
O——.

POTATO-GRINDING MILLS.

Sir,—A Correspondent in No. 65, vol. III. of your valuable publication, requests a description of the mill used by bakers for the purpose of grinding potatoes. He was probably led into the belief of the reality of such a machine by the following barefaced assertion in 'Cobbett's Cottage Economy:'—

"It is a notorious fact that the bakers, in London at least, have mills wherein to grind their potatoes, so large is the scale upon which they use that material."

Now, Sir, I beg to say that I have inquired of the principal machinists in London respecting these aforesaid mills, and have been assured by them that none ever were constructed for the use of bakers. So much for Cobbett's *notorious fact!*

I am, Sir,
Your obedient servant,
Argus.

MATHEMATICAL CASE.

Sir,—I am one of a party whom your Magazine has induced into a habit of mathematical disquisition. We frequently have disputes; and although, as we have read *veritas in puteo*, yet, notwithstanding, some one among us has been able to fetch it out, without having, as yet, had recourse to what we consider the weekly dip of the master-bucket. At present we are troubled with two refractory members on a subject in dispute; and although they admit we (the majority) have dipped our buckets in the right well, yet the *water* appears so muddy to them, that they give us *credit* for stirring up the sediment without having obtained the object of our dip. But to the *point*, as simply as possible. Can a straight line touch the circumference of a circle in any POINT, so as to be at a less angle than 90 degrees, with the radius drawn from that point to the centre? *We* think it can; inasmuch as the deviation of the curve line from the perpendicular, AB, must be *infinitely* divisible, as the diagonal AC may be drawn so as to leave the perpendicular AB, *in any imaginable distance*, at a less angle than the curve line; and as A is a *mathematical* point from which it is palpably evident the curve line, the diagonal, and the perpendicular, may diverge.

Will some of your readers be so condescending as to explain the thing with more clearness, as early as convenient?

We are, Sir,

Your constant readers,

DISCIPULI.

Limehouse, August 17th, 1825.

ON HIGH AND LOW PRESSURE BOILERS.

BY A. B. QUINBY.

From Professor Silliman's American Journal of Science and Arts.

The following is the substance of a paper communicated by the author to the Committee appointed, by the Literary and Philosophical Society of the City of New York, to investigate the causes which gave rise to the explosion of the boiler on board the steam-boat Ætna:—

To determine the comparative eligibility of the *high* and the *low* pressure steam-engine, the two following things appear to me necessary to be considered. *First*, the liability of each engine to explode; and, *secondly*, the danger or injury which each engine is capable of producing in case an explosion takes place.

To determine the comparative liability of the two engines to explode, it will be necessary to consider the four following things:—The diameters of the boilers used in the two engines, the elastic force of the steam in each boiler, the tenacity of the metal of which the boilers are composed, and the thickness of each boiler.

The diameter of the boiler on board the Ætna was thirty inches, and the diameter of a boiler for a *low* pressure engine of equal power would be about ninety inches, or *three times* as great.

The elastic force of steam in the boiler of the Ætna was usually 150lbs. per square inch, and the elastic force of steam in a *low* pressure boiler is usually 10lbs. per square inch.

The tenacity of the metal of which boilers are composed is about 60,000

lbs., or six-sevenths that of good wrought iron.*

As, however, the cylinder which constitutes the boiler is not *solid* metal, but is composed of plates *riveted together*, it will be necessary to diminish the number which expresses the tenacity.

Let, therefore, the tenacity be put at 30,000lbs. in place of 60,000.

The thickness of the boiler in the Ætna was $\frac{3}{8}$ of an inch, and the thickness of a *low* pressure boiler for an engine of equal power would be about $\frac{1}{4}$ of an inch.

From these data it is easy to calculate the comparative liability of the two engines to explode; for, by Mechanics, the force of steam which a *high* pressure boiler 30 inches in diameter, and $\frac{3}{8}$ of an inch thick, is capable of resisting, is equal to the thickness multiplied by the tenacity of the metal, divided by half the diameter; $= \frac{3}{8} \times \frac{30,000}{15} = 750$lbs., which is 600lbs. more than the usual working pressure, or 5 times the usual working pressure.

And, next, the force of steam which a *low* pressure boiler 90 inches diameter, and $\frac{1}{4}$ of an inch thick, is capable of resisting is $= \frac{1}{4} \times \frac{30,000}{45} = 166\frac{1}{3}$lbs.; which is $156\frac{1}{3}$lbs. more than the usual working pressure, or $16\frac{1}{3}$ times the usual working pressure.

Hence, if the excesses merely be considered, laying aside the ratio of the elastic force of the steam in the two boilers, it appears that the *high* pressure engine is safer by $443\frac{1}{3}$lbs. per square inch, than one of the *low* pressure kind. But, on the contrary, if the ratio of the elastic force of the steam in the two boilers be considered, and the excesses be laid aside, it will appear, from the above results, that the *low* pressure engine is more than *three times* as safe as one of the *high* pressure kind; or, that the safety of the *low* pressure boiler is to that of the *high* pressure boiler in the proportion of $16\frac{1}{3}$ to 5.

But it can be shown that either engine can be made entirely safe, and that one kind is not, *in fact*, any more liable to explode than the other.

To prove this we have (by Mechanics) the thickness of a *low* pressure boiler 90 inches in diameter, capable of resisting 10lbs. per square inch, $= \frac{45 \times 10}{30,000} = .015$ inches; and that of a *high* pressure boiler 30 inches in diameter, capable of resisting 150lbs. per square inch $= \frac{15 \times 150}{30,000} = .075$ inches.

And, now, if we multiply the first of these results by 10, we shall have .15 inches for the thickness of a *low* pressure boiler capable of resisting 10 times the usual working pressure, which is 90lbs. above the usual working pressure.

And the thickness of a *high* pressure boiler capable of resisting 10 times the usual working pressure is $= \frac{15 \times 150 \times 10}{30,000} = .75$ inches; and, lastly, the thickness of a *high* pressure boiler capable of resisting 90lbs. per square inch above the usual working pressure is $= \frac{15 \times 150 + 90}{30,000} = .12$ inches.

Hence, as it is fully practicable to make a boiler of a thickness equal to any of the foregoing results, it is plain that one kind of engine may be made just as safe as the other.

I shall merely add, that as the tenacity of metals is diminished by an increase of temperature, the tenacity in the case of the *high* pressure boiler should have been taken some less than in the case of the *low* pressure boiler.

VALUE AND UTILITY OF WATERFALLS.

The facility of erecting a steam-engine almost on any spot seems to have diverted the public from attending to the vast utility of steady waterfalls. The action of what is called *a twenty-horse power engine* is just equal to the impulse given by 1000 cubic feet of water falling in a minute through the height of ten feet. But the yearly cost of an engine of that dimension is, under

* The tenacity of any metal is usually expressed by the greatest weight in pounds which a bar one inch square, of that metal, is capable of sustaining when pulled endwise.

the most favourable circumstances, estimated at 1000*l.*, which is, therefore, the annual saving produced by such a fall of water.

REV. MR. CECIL'S GAS VACUUM ENGINE.

Sir,—I beg to state, in justice to Mr. Cecil, whose Gas Machine is noticed in one of your late Numbers, that I have seen the machine work at the inventor's rooms at Cambridge, and that in the year 1822, so that there can be no doubt of the priority of Mr. Cecil's claim. The partial vacuum—for, though nearly perfect, it is not quite so—is produced by explosions of hydrogen gas and atmospheric air in a cylinder. It is always ready to work, without any previous preparation, at a moment's notice.

I am, Sir,
Yours respectfully,
F——.

MUSLIN MANUFACTURE.

The improvements in the manufacturing of muslins appear daily on the increase. A very few years ago the bleaching of webs in the chain was introduced, and it is now become very general; and dyeing has been successfully performed in Mr. Forrester's starching work, Park-lane, Mile-end. This novel process, which is very simple, and all done by machinery, reflects great credit on the ingenious inventor. It is a much superior and more level dye than can be done in the hank, and, what is of great importance, it is a saving to the manufacturer of from five to ten per cent. according to the fineness of the yarn. This department of Mr. Forrester's work has been partially going on for eighteen months, but, since its commencement, he has brought it to such perfection by the great improvements he has made in it, that it is now quite original, and the accession of business is liberally rewarding the inventor.—*Glasgow Journal.*

MULTIPLICATION IN ONE LINE.

Sir,—Your Correspondent whose own brother refused to tell him how to dye silk a particular colour, has reminded me of a friend who once asked his father to instruct him how he multiplied by a number of figures in one line, and who died without communicating the secret. It is not, however, lost, for I have lately learned there is a gentleman in the metropolis who can do the same thing; perhaps there may be many, and it has occurred to me if any one, through your means, would explain the way in which it is to be performed, it might be of service to many of your numerous readers.

I am, Sir,
Your obedient servant,
W—— W——.

SHARPENING RAZORS.

Sir,—Having spent a considerable sum for hones, straps, and various articles usually advertised for sharpening razors, I have found them all nearly useless. The best cutler I ever met with was the late Mr. Offord, of Colchester, and in giving an edge to a razor he was unrivalled. His plan was this:—After whetting the razor on the hone and strap, he finished by drawing the razor backwards and forwards on a piece of calico or fine linen: this took off all the grease attached to the edge of the razor, and enabled it to cut. If any of your friends and readers will try this, they will find it answer, as I am in the habit of proving it every day.

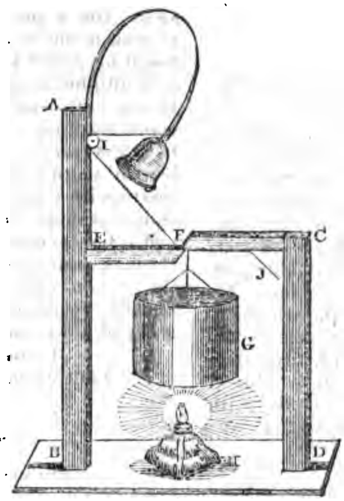
I am, Sir,
Your obedient servant,
Alpha.

AIR AND WATER ENGINE.

If your ingenious Correspondent who invented the Air and Water Machine, would explain what calculation he wants a little more at large, I will endeavour to make it.

I am, Sir, yours, &c.
F. O. M.

SIMPLE ALARUM.



SIR,—An Alarum being a most useful piece of furniture, at one time or another, in every house, perhaps you will not think the above sketch of one, both cheap and simple as well as original, unworthy of your notice.

I think the Alarum of which you have given an engraving in a former Number of your work, and which is made to act by the running of sand, is liable to one great objection, viz. that, should it be required to run for ten or twelve hours together, the quantity of sand must be so great, or the passage so extremely small, with a proportionably fine sand, that either way it would be difficult, if not impossible, to make it answer the end proposed, unless it be made inconveniently large and cumbersome.

The above will, I think, be found to answer every purpose of the Alarum often prefixed to table or kitchen clocks, and can be constructed at a very trifling expense.

I am, Sir,
Yours obediently,
F. W. C.

Lower Brook-street, Grosvenor-square,
August 15th, 1825.

Description.

AB and CD are two uprights, of wood.

EF and FC are two small pieces of wood, with small hinges or pins, at E and C.

G is a vessel, made of glass or tin, and suspended from F, to contain water, under which is placed the lamp, H.

By the heat of the lamp the water gradually evaporates or flies off in steam, which, lightening the vessel, G, allows the piece of wood, EF, moving on the hinge at E, to escape from under the point, F, of the piece of wood, FC, which flies up, from the strength of the spring of the bell, to the wheel or pulley, I, and thus sets the bell at liberty and causes it to ring.

J is a bracket or triangular piece of wood, to prevent the vessel, G, from falling on the lamp after the bar, EF, has escaped from under it.

Observation.

The quantity of water for a certain number of hours, the size of the wick, &c. can be calculated, with ease, from a few hours observation. A slit should

be cut perpendicularly in the piece FC, so that the thread by which the vessel is suspended may be shifted nearer towards C, as occasion may require.

BRASS PICTURE FRAMES.

Sir,—As your valuable Magazine appears open to the humble mechanic as well as to the man of science, it gives me confidence in writing to you for the first time, though a subscriber from the commencement.

In a recent Number is an inquiry, whether there could not be a Brass Picture Frame made to answer the same as a gilt and carved one? Permit me, Sir, to state that I am at present engaged in getting up a set of patterns for that purpose, and in a short time shall be able to furnish any of your Correspondents with them, if they send the size or a design according to their own taste. They shall be fitted up in a superior style, and I make no doubt but it will have the desired effect; they will be much less expensive at first, and their extra durability cannot be questioned.

I am, Sir,

Your most obedient servant,

Maurice Garvey,
Modeller.

No. 9, Somer-street, Birmingham,
September 6th, 1825.

SUBMARINE FOREST.

The Director of Manx Museum has published, in one of the Isle of Man Papers, the following account of a singular phenomenon now visible on the coast of the Isle of Man:—

It is a well-authenticated fact, that the last winter was characterised by a continued succession of heavier storms from the S.W. than what had been experienced for a great number of years. It follows, that the bed of the sea on the southern side of our island was frequently convulsed; that its shingle, shells, and wreck, were often cast upon the neighbouring shore, and its upper stratum laid bare at low water mark, to the examination of the curious.

This was precisely the case in many situations, but in no place so prominently remarkable as on the coast of the ocean immediately opposite Mount Gawne, the seat of Edward Gawne, Esq., lying between the bay of Castle Town and Port le Murray. It may be proper here to remark, that during the prevalence of the late tropical weather, the reflux tide flowed out to a greater distance than what is on Manx record; and that, in consequence, the exposed bed of the sea presented appearances of a novel or unusual character.

It was not, however, till towards the end of last month that such unusual appearances attracted any notice, or met with any investigation. It was not till the 25th ult. that the family of Mount Gawne, perceiving several children intensely occupied at low water mark, immediately opposite the house, walked down to learn the object of the children's research; when, to their inexpressible surprise, they found them standing on a bank of decomposed wood, generally of hazel, as was evident from the texture of the bark, and the existence of several nuts and clusters of nuts every where observable in the organic stratum.

The company who visited this grand phenomenon, had the good taste to select some fine specimens of these antediluvian remains, and they had also the great goodness to transmit them to the Manx Museum, where they are now deposited, for the inspection of the public. The principal specimen consists of a cluster of nuts in a matrix of decomposed vegetable matter; the second specimen is a piece of hazel, with every feature perfect; and the third is a detached nut, in such a state of florid ripeness as to be split at end.

This discovery—these facts,—are of stupendous magnitude. They decide the question as to the history of the earth, and the nature of islands. They prove that the

present earth is nothing but the ruins of a former world; that islands are only the summits of vast mountains, and that the lower grounds had been dry valleys, previously to their having been subject to the irruption of the waters of the "great deep."

Without dwelling any longer upon generalities, let us confine ourselves to one particular fact. The stratum or bank of hazel-wood, in question, is of so extensive and fixed a nature, as not to admit of the hypothesis of its being foreign to its present situation. It will not admit the assumption, that it was removed from a former site to its present bed by a supernatural agency; hence it must be allowed, that its existing situation was once a fertile valley, where trees grew, and fruit flourished.

But it may be urged that, as in many instances in other countries, the waters of the ocean have gradually gained upon the Manx coast. This argument appears fair. In the case before us, however, it is neither tenable nor sound. Why? Because, had the waters gained gradually on the hazel plantation, there would have been no decomposed foliage—no perfectly ripe fruit? Whereas the ripeness of the fruit, and the remains of the foliage, indicate a sudden inundation, and attest, that God called for the waters of the sea, and poured them forth on the "face of the earth." Even the period of the year in which this terrible visitation occurred, is made abundantly apparent. The perfection of the nuts bears evidence it was autumn; and that it pleased him who "measures the waters of the sea in the hollow of his hand," and "who sitteth upon the flood," to devastate the earth when it abounded most in riches and beauty.

From the trend of the hazel bark to the coast of Wales, the natural conclusion is, that the Isle of Man formed the northern boundary of Wales. In respect to the material of the bark, the wood is not in a state of petrifaction; it is merely in a preserved condition—in such a one as may be attributed to the saline and marl strata on which it reposes, or with which it is incorporated throughout. So remote is the hazel-wood from a petrified quality, that it has not even lost its elasticity; on breaking, it first bends.

"EDUCATION OF THE PEOPLE."

We have been much gratified by the perusal of a pamphlet under this title by Mr. Jas. Scott Walker. He embarrasses his subject a little, by bringing more facts to bear on the question than he is successful in showing *do* bear equally or sufficiently upon it; but, upon the whole, it is well calculated to enlighten and fortify the convictions of those who are already friendly to the universal spread of knowledge, and to make new converts to this noble cause. We shall quote, as a specimen of the work, a passage, which shows, in a very sensible manner, how groundless the apprehensions of those are, who imagine, that to make mechanics more intelligent and better informed, is to make them worse servants and members of society.

"'Tis but to know how little can be known,
To see all others' faults, and feel our own."

"To those who are of opinion, that even the moderate share of intelligence which a mechanic may imbibe, from books or lectures, during the short cessation from his labour, would tend to render him proud, inattentive to his work, and insubordinate to his employers, it may be answered, that intelligence can no more inflate the mind with inordinate conceit, than it can debase it into abject servility. It has rather the effect of reducing overgrown pretensions, by convincing us how little we, in reality, know; how far we are removed from perfection; and how much we must struggle to attain ere we can satisfy our own honorable ambition, or

command the lasting approbation of a discerning community. History, and the examples daily before his eyes, will convince the mechanic, that it is not by contemning his seniors, or neglecting their instruction, that a trade or craft, which is worth the learning, is to be acquired. To assume the master, without the master's skill and experience, were indeed a hazardous game; for, as Phaeton, when he daringly took the guidance of the chariot of the sun, whose fiery steeds had been accustomed to a warier hand, was dashed to the burning earth for his temerity, so insubordinate pretension brings at once its overthrow and disgrace. But if there be still those who endeavour to reconcile the anomaly, that a course of education, which comprises the instruction of the operative classes in their relative duties in society, would tend to render them attentive and insubordinate, happily they can be referred to the testimony of facts. There are few respectable masters, and surely none avowedly, who would not employ a workman of intelligence, rather than a man who had barely capacity for the performance, under his own constant inspection, of the commonest branches of his trade, and in whom he can have no confidence when he is not on the spot. An intelligent workman, too, may often become of the utmost value to masters or proprietors, in cases where extraordinary exertions are required, or where foremen or overseers fall a prey to sickness or death. There can be little doubt, but without some generally intelligent workmen, extensive establishments, involving even a national interest, would frequently stand still. The selection from the workmen of a new overseer falls inevitably on the most intelligent and skilful, and affords a practical proof that intelligence enhances the utility of every labourer. The case will also apply to maritime life. A few months only have elapsed since it was announced in the New York papers, that a fine and valuably laden ship belonging to Salem, and which had lost both captain and mate by sickness on a distant voyage, was safely carried to her port of destination by a young man of eighteen years of age, one of the crew, who, to his honour, though poor, had early applied himself to the study of navigation.*

"Again; the late combinations, in which violent or unmanly conduct has been resorted to (and there are only a few isolated cases), have been, without almost an exception, the work of the most ignorant men of the trade to which they belonged; and their proceedings have been publicly deprecated by the general body of workmen, amongst whom are many intelligent men, who have headed their fellow-labourers in urging their claims with temperance, and without infringing the law. The dictation to masters, the intimidation of men, and the absurd regulations of the London shipwrights,† have all been the result of ignorance, combined with the distresses arising amongst the workmen from the high prices of provisions; and in place of forming a ground for the discouragement of education amongst them, ought to urge those who have the means, the more strenuously to promote it. Were the men better informed, I do not say they would not combine—for cases have occurred, and will occasionally occur, where, in justice to themselves, they must use means to obtain a fair price for the only stock they have to dispose of—their labour; but combinations would assume no dangerous or violent character, and reasonable overtures would never fail to be met in a proper spirit. The men have, on this point, I am of opinion, sometimes been unme-

* Mr. Brougham, the Rev. A. Wilson, and others, have lately furnished several examples of the advancement of workmen, in consequence of their attendance at Mechanics' Institutions.

† On this point the writer seems not sufficiently informed.—EDIT.

ritedly aspersed. They are not prone to combine. A strike is always attended with distresses to themselves, which they would not rush upon, but upon compulsatory occasions; and, in fact, the advances which many master tradesmen have made of wages, and some of them, to their honour, upon a bare requisition, are evidence of the general justice of the claims of the workmen. If they have, in some cases, been intemperate, let it be remembered that, as Lord Bacon says, there is no rebellion so terrible as the rebellion of the belly; and it is to be hoped, that the liberty now enjoyed by both parties freely to dispose of their marketable commodity to the highest bidder, will speedily introduce amongst them a feeling of kindness and conciliation, which shall be productive of mutual benefit."

MR. VALLANCE'S DOUBLE CRANK.

SIR,—I should be much obliged to your ingenious Correspondent, Mr. Dixon Vallance, for a rather more detailed account of the action of his Double Crank; as to me it does not appear to offer any advantage like the double crank described in a paper I sent some time ago, extracted from Venturoli; but, on the contrary, appears to me, from the imperfect idea I can form from the drawing, to be calculated only to impede all motion whatever, inasmuch as the rods working the cranks are of different lengths.

I am, Sir,
Yours respectfully,
F. O. M.

FIXING CRAYON COLOURS.

Apply drying oil, diluted with spirit of turpentine, to the back of the picture; after a day or two, when this is grown dry, spread a coat of the mixture over the front of the picture, and the crayon drawing will become literally an oil painting.

MR. WATT.

Dr. Alderson, President of the Hull Mechanics' Institute, in an address read to the members on the 1st of June last, and now published, says—"I do not give Mr. Watt any credit for his governors, or centrifugal regulators of valves, as some have done. The principle was borrowed from the patents of my late friend Mead, who, long before Mr. Watt had adapted the plan to the steam-engine, had regulated the mill-sails in this neighbourhood upon that precise principle, and which continued to be so regulated to this day.

SECRETS IN SELLING.

SIR,—I have made the following endeavour to satisfy C. M., p. 347.

Suppose, when the density of air is S, a body, whose magnitude $=M$, balances a pound weight, whose magnitude $= M$. Now, suppose the density of the air to be increased by a quantity, σ, then, by Hydrostatics, the body will lose a part of its weight, $= M \cdot \sigma$, while the pound weight only loses a part, $\mu \cdot \sigma$.

$\therefore W - M \cdot \sigma$ is the apparent weight of the body, and $W - \mu \cdot \sigma$ is the apparent weight of the pound; and $(W - \mu \cdot \sigma) - (W - M \cdot \sigma) = M - \mu \cdot \sigma$, is the weight lost by the person who sells the body M.

I am, Sir,
Yours respectfully,
F. O. M.

P.S. It is needless to remind C. M., that the height of the barometer depends on the specific gravity of the air.

EXTRAORDINARY INFLUENCE OF THE MOON.

If an animal, fresh killed, be exposed to the full effulgence of the Moon, it will in a few hours become a mass of corruption; whilst

another animal, not exposed to such influence, and only a few feet distant, will not be in the slightest manner affected. Fruits also, when exposed to moonshine, have been known to ripen much more readily than those which have not; and plants shut out from the sun's rays, and from light, and consequently bleached, have been observed to assume their natural appearance, if exposed to the rays of a full moon. In South America, trees cut at the full of the moon split almost immediately, as if torn asunder by great external force. All these are remarkable and well-established facts, but have never as yet been accounted for.

INQUIRIES.

NO. 150.—THE SACCHAROMETER.

Sir,—Examining a Saccharometer a few days ago, I observed the scale graduated from 0 to 40 pounds. I should feel obliged if any of your Correspondents would inform me, through your useful miscellany, by what method I may discover the *specific gravity* of a fluid heavier than water, by means of such an instrument. For example:—On immersing the instrument in a fluid, it floats with 20,0 at the surface, then $20{,}0 \times 2{,}5 = 50{,}0$ pounds of saccharine matter, per barrel, in the fluid. I wish to know (this being given in) in what manner the specific gravity may be found?

I am, Sir,

Your obedient servant,

Bung.

23rd August, 1825.

NO. 151.—ARTIFICIAL LEG.

Sir,—I shall feel greatly obliged if any of your Correspondents will inform me, through the medium of your useful and valuable work, the best principle on which an artificial leg can be constructed, the natural one having been amputated above the knee? I wish also to know what the weight of one would be, made on the best and lightest principle? One has been made, but was found much too heavy for the wearer, who is a female of light make. I would have no objection to treat with some mechanical man to construct one on a principle of his own, which, of course, must be under a certain weight, and warranted to answer the purpose.

I am, Sir,

Yours respectfully,

W— J—.

NO. 152.—NETTING SILVER AND BRASS WIRE.

Required the construction of a small portable machine to net or interweave the finest silver or brass wire?

NO. 153.—MANAGEMENT OF BEES.

Sir,—A Correspondent in Kent will be obliged if any economical manager of bees will inform him of the best mode of extracting the whole of the wax from the combs of old hives. Boiling, and straining afterwards, while yet hot, through a cloth, assisted by the pressure of two long sticks (as recommended by Keys), does not remove half the heated mass contains; this is very evident when it cools. Probably some sort of press might answer the purpose with iron plates. The mode of constructing one, and the manner of heating the plates are required, or any other means tending to the object desired will be gratifying.

I am, Sir,

Your humble servant,

* * * * *.

ANSWERS TO INQUIRIES.

NO. 139.

REAL AND APPARENT TIME.

SIR,—Casting a beam of rays over page 336 (No. 105) of your Magazine, we observed a query of your Correspondent, "H. M. M." relative to the time of our rising and setting; and although we can by no means sanction the liberty which some of your race assume, of prying into our movements, yet, as a mark of our approval of the part which you take in co-operating with us in our gracious intentions of enlightening mankind, with all such knowledge as is befitting their station to receive, and our dignity to impart, we permit you, by these presents, to inform your Correspondent, that, in conformity with our benevolent purpose of dispelling the gloom which in our absence envelops your earth, we have sanctioned your atmosphere to refract a certain limited portion of our rays, in such manner as apparently to prolong the period of our presence; and that, on referring to your almanacks, we find that this refraction is taken into account, as your Correspondent might have perceived, had he referred to the reported time of our rising and setting on the 21st of March, or 23d of September, which being the days we cross your equator, would be exactly twelve hours long, exclusive of refraction. Your Correspondent is therefore correct in setting his watch at 50 minutes after seven, which, on the 30th of July, is the mean time of our centre appearing in the horizon of your city of London. Nevertheless, as for divers weighty reasons us thereunto moving, we do not devote equal portions of our presence to places of different latitudes, the time stated in the London almanacks will often vary a minute from the time at Bath, and to a much greater extent in other parts of England; for a correct method, therefore, of finding the time of our visible rising and setting, we refer your Correspondent to page 40 of White's Celestial Atlas, wherein it may be found for any part of Great Britain.

We greet you with our best wishes for the success of your Magazine, and assure you that, on all proper occasions, we shall continue to throw light upon your researches.

Signed, THE SUN.

Olympus, Sept. 1st, 1825.

SIR,—The equation of time is a correction rendered necessary on account of the inequable motion of the sun in the ecliptic, and hence, I apprehend, no correction is due for the cause mentioned by H. M. M.

I am, Sir,

Your obedient servant,

F. O. M.

NO. 142.

"QUESTION IN TRIGONOMETRY."

SIR,—I do not think it possible to obtain a method to measure heights and distances from *one station;* at least, it cannot be done by Trigonometry. To resolve any triangle, there must be given the three sides—two sides and the included angle, or two angles and the included side. From one station, the Theodolite, or any other instrument for taking angles, will only measure the angle of elevation, and from *this alone nothing can be resolved concerning the distance and perpendicular height* of an object; as, at the same elevation, it might be one, two, or ten hundred yards distant, or high. When two stations are fixed on, and the distance from each other measured, by taking the elevation at each station, the distance and height are easily acquired by those who are acquainted with plane trigonometry; as it then falls under the last of the above-mentioned cases, having two angles and the included side given.

You have already published what I conceived to be the most simple method of measuring heights, and more especially for the use of those who did not understand the principles of trigonometry. "S. M." thinks, that a method of his, stated in Number 67, is superior to mine, both in point of accuracy and expedition. But the method of observation is nearly similar in both cases; for although on the base line I say that a *tenth may be measured*, the instrument will just as easily point out one-half, or the whole of the height required. The only scope for error in taking the observation, by either method, is not correctly noting the situation of the plummet-line on the instrument, or not correctly measuring the distance between the two stations. Both methods are in precisely the same situation in this respect, and therefore both liable to error—both demanding the utmost care of the operator; and the same may be said of every method of measuring heights by observation.

But, in point of expedition, I think that my method has a decided superiority. In taking the observations, one method will occupy about as much time as the other; but by my method the measurement between the two stations is a tenth or half, or the whole height of the object sought, whichever the operator first decided upon; and no farther operation is necessary, save doubling it, if it be half, or adding a cipher to it if it be a tenth. By the method given by S. M., after the observation is complete, in order to arrive at the result, the length between the stations is to be multiplied by the elevation at the nearest station; this product is to be divided by the difference of the two elevations, and this product is to be again multiplied by the nearest elevation. Here is evidently more time required, and more danger of inaccuracy, from the multiplicity of the operations. Let those who wish to make use of either judge for themselves: we are generally fond of our own bantlings, therefore partial, and not qualified to judge when peculiar merit is the question.

I am, Sir, yours, &c.

R. H.

CORRESPONDENCE.

C. P. of Croydon, states, in answer to the inquiry of a Correspondent in our last, that Zinc Plates may be obtained, for the casing of Mill-stones, of Mr. Beauchamp, dealer in tools and metals, Grafton-street, Soho, London.

R. H., at p. 309, vol. IV., says—"I hope G. A. S. will not be offended at me for once finding him in error." "This (says an old Correspondent, Mr. Joseph Hall) is amusing. The rule given by R. H. will always produce a wrong result. He makes the solid content of the piece of timber 13½ feet; it ought to be 15 feet exactly, according to his rule, for $\frac{12^2+6^2}{2} \times 12 = 15$ feet. Now G.A.S.'s rule marks it 12 feet. The exact solidity of the piece is neither more nor less than 13 feet. So you see G. A. S. is nearer the truth than R. H."

We have no recollection of Mr. Allingham's paper. It certainly never reached us.

R. C. shall have an early place.

Communications received from—B.—Mr. Pasley—Mr. T. Bell—R. H.—T. M. B.—F. O. M.—A Man in the Moors—Clowe—Tauntoniensis—Junius—Felix Ford—A. M.—Revaew A—A Member of the Brighton Mechanics' Institution—An Automaton.

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Mechanics' Magazine,

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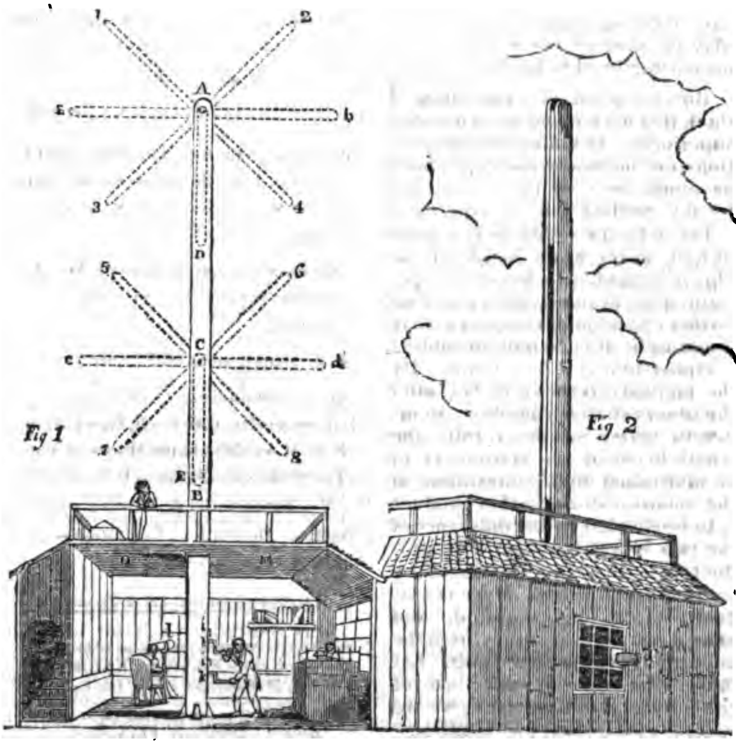
"To industrious study is to be ascribed the invention and perfection of all those arts whereby human life is civilized, and the world cultivated with numberless accommodations, ornaments, and beauties. All the comely, the stately, the pleasant, and useful works, which we view with delight, or enjoy with comfort, industry did contrive them—industry did frame them."—*Barrow.*

THE SEMAPHORE,

NOW IN USE BETWEEN LONDON AND PORTSMOUTH.



THE SEMAPHORE.

SIR,—Seeing a proposal for a Hydraulic Telegraph in a late Number, I beg to offer a short description of the Semaphore (which is now at work between London and Portsmouth), which will, I think, prove its superiority.

I am, Sir,

Your most obedient servant,

F. O. M.

Description.

AB (fig. 1) is a post, consisting of two boards, between which are two arms, which, when at rest, hang down in the positions AD, CB, and are made to turn by means of small winches, *k k*, in the room whose roof is OM: these arms may be moved into the positions A 1, A 3, &c. C 5, C 7, &c.

A 1, A 3, A 2, &c. represent numbers (which numbers are known only to those who have signal-books); suppose 1, 2, 3, &c. Then, when a message is to be sent up, for which there is no particular signal, the alphabetical signal, or signal that they are going to spell, is made as a preparatory; we will suppose this to be by placing the upper arm in the position *Aa*. Then A 1, A 3, &c. stand for A, B, C, &c. as far as H: the rest of the letters are made up by combinations of the two arms; thus A 1, C 8, may stand for 9 or 1, and this operation is repeated from one station to the next till the message arrives at the Admiralty or Portsmouth; thus anything that can be spoken may be communicated. The time has been sent down to Portsmouth and acknowledged back in 56 *seconds;* this may give some idea of the perfection of the Semaphore.

Fig. 2 represents the external appearance of a Semaphore, T being the fixed telescope looking to the next station.

P.S. *ii* are small indices; showing to the man who works the Semaphore the number he is making; *l*, the telescope, fixed in the direction of the next station.

TANNING.

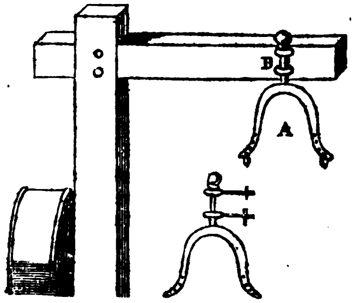
The subjoined extract contains the peculiarity of a process of tanning, for which a patent was recently obtained. The extract has been taken from the interesting "Travels in England, Scotland, and the Hebrides," by Faujas Saint-Fond.

"I had a conversation upon this subject with a very intelligent Englishman, who proposed to conduct me to a manufactory of Turkey leather, situated in one of the extremities of London, and directed by persons of the name of Lorraine. I was told that I should there see a press of very great force, the effect of which was to perfect the quality of the skins to be prepared into Turkey leather. * * * * The great press, however, which is not shown to every body, was set in motion before me, and I was made acquainted with all its details. It is made of iron, and weighs 22,000lbs. It does not differ from ordinary presses in any other respect than being of a greater size, and having all its parts perfectly finished. It is usually worked by four men, and produces a very powerful pressure; but when it is required to employ the highest degree of force, two horses are yoked to it. Skins of different kinds, which in ordinary manufactories would have been sufficiently dressed, were wetted and put into the press. The water which oozed from it was collected, and during the last strokes of the press a thick oil swam on the top. This oily matter in time becomes rancid, and acquires an acid quality, which not only alters the colours of the skins, and gives them a blackish appearance, but also corrodes their grain, and the reticulated substance which gives them consistence; they are thence of little durability. This observation deserves to be taken into consideration by those who are engaged in this business. As the manufactory is considerable, a good deal of oily matter, which would otherwise be left, is obtained by this mode, and made into tallow.

IMPROVEMENT IN PUG-MILLS.

SIR,—Reading a letter in Number 95, of your most useful and entertaining publication, the Mechanics' Magazine, which recommends an improvement in the Pug-Mill, it may not be unacceptable to some of

your constituents, if I impart a trifling improvement of my own; and, at all events, if the animals employed in mill-work could return thanks for it, I am sure they would.



A, the yoke, being made of iron, with its pin, B, to the shoulders, is fixed on the shaft by two ring-bolts, fastened by nuts on the other side.

The yoke is thus moveable, and acts on a pivot or swivel, giving full scope for equal pressure, instead of lateral, and as greatly increases the power as it does the ease of the animal, by permitting him to work in the centre of the mill-track, or on a straight line of road.

It is possible so simple a thing should neither be new or original; but knowing that many of the common mills, in town and country, have not the advantage of its power (which I have experienced), I subscribe myself, no millwright, but

Your subscriber,
W. H. S.

Weymouth-street, Aug. 13th.

MR. SOUTH'S COLLIMATION ADJUSTMENT OF A TRANSIT INSTRUMENT.

Sir,—If the ingenious Mr. South, the author of a paper among the Memoirs of the Astronomical Society, Part II., is now in England, I shall feel obliged to him for an explanation of what he says, at the bottom of page 234, of that publication, respecting the Collimation Adjustment of a Transit Instrument. His words are:—"Having therefore adjusted the collimation of the instrument by the land-mark, as I consider approximately, I direct it to such an one of the stars as is nearly on the meridian, and the nearer to the pole the better. I note its transit over the first, over the second, and over the third wire; I then reverse the instrument, and note its transit over the fourth and fifth wires." On the next page he says—"Now, by the time this correction is made, probably another star of the list may present itself, which must be treated in the same manner, till, on reversion, every discordance between the observation vanishes." Now, Mr. Editor, I do not see it practicable to follow Mr. South's directions here, in the case of reversing the instrument, and placing it instantaneously in the plane of the meridian, for accurately taking the time of the passage of the star from the mid-wire to the fourth; and I would ask, in what way can the instrument be put in the plane of the meridian, when the meridian land-mark cannot be seen, or resorted to, in the night? If the instantaneous reversion of the instrument cannot be effected, the difficulties which are intended to be overcome do not at all vanish, and consequently Mr. South's method is totally nugatory. Should he mean, that an observation of the interval of time from C to B, as he expresses it, and B to A (and not from C to A, as it is erroneously expressed), be made on the following night, or first favourable night subsequently, the rate of the clock being taken into the computation, I should then deem his method feasible, and not to be despised.

I have judged it not improper to solicit the favour of the medium of your excellent Mechanical Magazine for the explanation of Mr. South's directions for verifying the transit telescope, and am, Sir,

Your obedient servant,
Felix Ford.

Sept. 12th, 1825.

STREET AND ROAD PAVEMENT.

It is the practice in Vienna and some other cities to pave the open courts of the hotels with blocks of hard wood, a few inches long, set

on edge, over which wheel-carriages roll almost without noise. We think a hint might be taken from this practice for paving our suspension bridges. A stratum of road metal, four or five inches thick, laid upon one of these bridges, will nearly double its weight, and render much additional strength and cost necessary. Were short blocks of hard wood substituted for the stone, *two-thirds* of the weight would be saved, and also two-thirds of the additional expense which a stone-road would occasion. Were the pores or tubular cavities of the wood previously filled with a calcareous or other stony solution, or even with pitch, its hardness would be a good deal increased, and its durability still more, by the exclusion of the water. As broken wood would answer for this purpose, and as the labour of cutting and laying would be comparatively small, we do not think the expense would much exceed that of M'Adam's road metal. We have often wondered, indeed, that the Vienna wooden pavement is not adopted in some of our most fashionable streets, where the noise occasioned by the constant passing of coaches must be felt as a serious nuisance. Were the paving of each street under the management of the proprietors, we have little doubt that improvements of this and other descriptions would be introduced.—*Scotsman.*

We extract the following account of the ancient Roman and Modern Continental Pavements from a letter recently published in the *Morning Chronicle*:—

On Pavements.

Of the ancient Roman paved roads, such as the Via Appia, the Sabina, the Flaminian, Emilian, &c. there are still many miles in perfect repair in Southern Italy, especially in the neighbourhood of Rome. The stones composing the pavement of these roads are uniformly of basalt,* of a polyangular shape, containing, on an average, about four or five feet surface, and about twelve or fourteen inches in depth or thickness. They are all more or less slightly pyramidical, and placed with the base or broadest surface uppermost. It is by no means, in every instance, as is asserted, that these stones are laid in a bed of mortar; in many situations I have found it to be otherwise.† Neither are their edges chipped with any degree of nicety; the juxtaposition is, however, well contrived, and indeed very remarkable; for although the stones vary *ad infinitum* in shape, angles, and more or less in size, they are fitted together as though each had been expressly cut for its situation.

It is necessary to remark, that the carriages used in Italy, both anciently and at the present time, are what would be deemed in England very light. It would appear that the carts of the ancient Romans were generally two-wheeled, drawn by two, or at most four, oxen. Travelling was, for the most part, performed on horseback, or in litters carried by two mules. Chariots for travelling do not appear to have been used at all, much before the close of the republic. They

* The preference for basalt was so decided, that where the roads, for instance, traverse the Appenines, composed of marble and the hardest lime-stone, basalt has still been used, though it must have been conveyed thither at a great expense. In some instances, however, I have observed a single line of large marble or lime-stone blocks applied as an edging or "curb" to the basalt. I am inclined to believe that this exclusive use of basalt is attributable to its being, although harder, less slippery than marble or lime-stone. I have particularly remarked, in the town of Caserta, where some of the streets are paved with lime-stone, and the rest with basalt, that the former alone are most inconveniently and dangerously slippery, although both kinds of stone are cut and laid in a similar manner.

† In most cases no more mortar was used than was sufficient to fill up the interstices between the stone, which interstices, from the shape of the stones, were much wider below than at the surface.

were both two and four-wheeled, but not made to carry more than two persons, besides the driver. They do not appear to have had any springs; the wheels were very low, and not more than thirty-two or three inches apart. So that, altogether, it may be presumed they were more calculated to wear and break up the bones of the riders, than injure the pavements over which they bounced.

The pavements most similar in construction and solidity to the ancient Roman, are the modern Neapolitan. The stones of these are also of basalt; but in lieu of being polyangular, they are rectangular quadrangles, mostly squares, generally of about four or five feet surface (two feet by two), and six inches in thickness. The sides are very accurately wrought as well as the surface, which is left as rough as is consistent with a good level: These stones are laid in a thick bed of the best Puzzolano mortar, and always so arranged that the lines of junction are never parallel with the line of road, but *cross it diagonally*. This pavement excels in evenness and level, is very permanent, but expensive, and liable to become dangerously smooth, which renders it necessary, from time to time, to cut grooves on the surface. The city of Naples being admirably provided with sewers and subways of the solidest construction, the necessity for disturbing the pavement very seldom occurs; so that the expense, though great, is pretty much confined to the first laying.

The pavement of modern Rome is also of basalt. The stones are parallelograms of about two cubes in length: and on being set up endways, they present about ten inches square surface. Although these stones are accurately cut and equal in size, they are simply fashioned by a few skilful blows of the hammer. More mortar is used in the construction of these pavements than even in the Neapolitan. I have observed the bed of the best Puzzolano mortar, on which they are laid, to be about a foot thick. Rome being so amply provided with the most extensive and complete sewers and subways of any city in the world, its pavement, or, as it may be called, this horizontal wall, has very seldom an occasion to be disturbed.

The next kind of pavements that it may be necessary to mention, are those of Florence, of Sienna, of Milan, and some other cities of Northern Italy. These may, indeed, be assimilated to a kind of stone railroad, as there are particular tracks allotted for the wheels, and others for the horses. The tracks for the wheels are composed of stones of very large dimensions; they are of marble, lumacular limestone, or of a very hard sand-stone, most of them, particularly at Florence, weighing several tons. They are laid with much precision in lines of about three feet broad. The spaces for the horses between these lines are paved with small stones, and are, as well as I can recollect, about four feet wide. In some of the squares the small pavement predominates, while the lines of large stone-way cross it in various directions. Nothing can be more easy or agreeable than this pavement, which is suitable to carriages of every description, without limitation or confinement.

I very much doubt whether, in point of durability, either the Roman or Neapolitan pavements would succeed in London. Considering the pliable nature of most descriptions of mortar, I suspect that the repeated shocks of very heavy carriages would pulverise and detach it from the inferior surface of the stones, and part of it would work out and the stone become loose. A further great objection to any such solid masonry pavements is, the frequent necessity of partially taking it up to lay gas and water pipes, and to repair our trumpery crumbling brick sewers.

The foregoing objections will equally apply to the modern Neapolitan pavements. The modern Roman has not the defect of being too smooth, but it has that of homogeneous solidity, which will not

admit of its being perpetually displaced for the temporary purposes above mentioned. Morever, where are we to get a sufficient quantity of such a Puzzolano mortar as is employed in Italy, with which the pavement becomes as one rock?

With regard to the pavements, or, as I have ventured to call them, the stone railways of Florence, Sienna, Milan, &c. &c. the objections to their adaptation to the streets of London must also be obvious enough. Independently of the enormous expense of such materials, such a system could never answer in streets where vehicles of all descriptions, going at every degree of velocity, have occasion to cross, pass, and run abreast of each other, over the entire breadth of the street. Such large stones, whether of granite or limestone, would soon become dangerously smooth, their longitudinal edges would wear, and ruts proportionally be formed along them.

PERPETUAL MOTION.

SIR,—From the ingenuity displayed by "Philo-Montis," in his contrivance to effect a Perpetual Motion, I am led to consider him to be a young man of very promising abilities; and I have no doubt, when he hit upon the idea which he has so well described, he thought he had achieved one of the greatest discoveries of the age. However, it happens, most unfortunately for speculators of this cast, that when the pleasing reveries and feeling of self-complacency, always attendant upon great success, have subsided, and left the mind to cool reflection, it is invariably found that some law of nature, some property of matter which had before escaped notice, steps in, and, at one fell swoop, the superstructure on whose battlements the projector had planted his fondest hopes, and claims to immortality, vanishes, as if by magic, and "leaves not a wreck behind." In the present instance, the unfortunate property of water, or other fluids, to rise to their own level, or stand at equal heights in the legs of an inverted syphon, proved fatal to the scheme of "Philo-Montis." I certainly consider the idea of gaining a perpetual motion, by the passing of bodies through mediums of different densities, is a very ingenious one, as it is the same in effect as if the specific gravity of the moving bodies was a variable quantity, which agrees very well with the definition of De La Hire, viz. "to find a body heavier and lighter than itself." But it strikes me very forcibly, that there is a better plan of applying this principle than the one described by P. M. Let an endless chain or rope be passed over a pulley, and through a hole of similar diameter made in the bottom of a vessel filled with water, so that one-half of the rope will always be in the water, and the other half in air; now let this chain or rope be divided into equal links or divisions, each constructed in the following manner:—Let pieces of cork, or any other light substance, be attached to the rope, exactly in the same manner as the whalebones are fastened to the stick of an umbrella, so that they may form a complete cylinder, when passing through the hole in the bottom of the vessel, and prevent the water from rushing out; but the moment one of these links gets through the hole (which will be immediately filled by another), these pieces of cork will radiate, or fly out, like the spokes of a wheel, and exert a force, proportionate to their lightness, to ascend to the top of the vessel, and thus give motion to the machine.

I cannot let this opportunity slip, without reminding you of the promise made in your 58th Number, to favour your readers with some illustrations of the Marquis of Worcester's Century of Inventions;* a production, the value of which is every day rendered more manifest by contrivances, of which he has given the "names and scantlings,"

* The continuation of them has been unavoidably deferred, but will shortly be resumed.—EDIT.

being announced to us week after week. Even the invention of G. M., given in your last Number, is a copy from No. 19 in the Marquis's Collection; and I have no doubt but that, in course of time, those inventions, which appear at first sight to be impossible, will not only be found practicable, but extremely simple in principle: for instance, No. 21 would be set down as chimerical, had we not a description of the apparatus given in all our modern Encyclopædias, under the name of the "Gaining and Losing Buckets." Although it is my opinion that the Century of Inventions has been the means of forming many a mechanical mind, by creating a spirit of inquiry after those subjects, yet I also believe it has fallen into the hands of few persons who have not, from that time, become determined perpetual-motionists; for if we can place any reliance upon the Invention No. 56, which seems so well attested, the Marquis was undoubtedly in the secret. The plan which most people adopt, who would accomplish the point by means of weights, is, I dare say, familiar to most of your readers, viz. by means of falling levers, a description of which may be seen in the "Mathematical Recreations," translated by the late Dr. Hutton; but, as the Doctor observes, "it may be easily shown that there is ONE position of the wheel in which the system is in equilibrium, and consequently will stop;" the plan may therefore be given up as untangible. I have seen and read of many attempts to overcome this obstacle by means of springs, &c. but they have been attended with no better success. I am, however, in possession of a method of constructing the machine, so that "all the weights on the descending side of the wheel shall be perpetually further from the centre than those on the mounting side," by which arrangements there seems to be an equilibrium in EVERY position of the wheel; and as I consider it to be the nearest approach to, if not the identical construction of the Marquis, it may be agreeable to your readers to know my method, which, with your leave, I shall shortly lay before them.

I am, Sir, yours, &c.
T. BELL.
Commercial-road, Whitechapel.

STEAM CARRIAGES.

WE took notice in a former Number (p. 90, vol. IV.) of different attempts that were making on the Continent, and in America, to apply Steam to the propelling of Carriages on land; and we have now to add an account of an invention of this sort in our own country. It is copied from the *Scotsman*.

"The constructor, Mr. Burstall, is an Englishman, and, we believe, an engineer by profession. We found him very communicative, and, as far as we could judge from a short conversation, well informed, not only in the mechanical details of the steam-engine and wheel carriage, but in the principles involved in their construction and motion. The Steam Carriage now preparing runs on four wheels, and the propelling machinery is so disposed as to make but an inconsiderable addition to the bulk of the vehicle. The coach is to be of the ordinary description, with seats for the usual number of inside and outside passengers. The distance between the wheels across is the same as in common coaches; but the length of the perch, or the distance between the fore and hind wheels, is one foot greater. The parts are disposed in the following order:—At the hinder end, behind the axle, and exactly under where the guard's seat is in our common coaches, is the boiler, which is a cube of strong malleable plate iron, about three feet long, three feet broad, and two feet deep. From this cube a neck about eighteen inches long extends backward, containing the grate, into which the coals are dropped gradually from a hopper by machinery. The upper surface of the boiler is nearly on a level with the hinder axle, immediately behind which the flue or chimney, which is about nine inches diameter and seven or eight feet high, stands up, its top being pretty nearly where the guard's head is in a stage-coach. Between the fore and hind wheels and under the perch is a shallow square copper box or cistern, which will contain about 12 cubic feet or 90 gallons of water. There are two steam-cylinders, of seven inches diameter, and

12 inches stroke, which are placed about a foot before the hind axle. The two beams, about three feet long, extend backward across the hind axle, and they move on a joint or fixed point at the back end, so that the lifting rod which passes down to a crank on the axle will make a stroke of about nine inches. The cylinders, beams, and other working gear, are all above the level of the axle, and will exactly occupy a boot of the carriage, which, in this case, will be merely a cover for this part of the machinery. The boiler, the cistern, and steam-cylinders, are so placed as to balance one another on the opposite sides of the axle of the hind or large wheel, which will thus very properly sustain two-thirds of the weight. The carriage for the passengers is placed between the hind and fore wheels, but somewhat nearer the latter than is usual. Over the axle of the fore-wheels, but rather in a lower position than the driver usually occupies, sits the director or steerer, who, by means of a teethed circular rack and a pinion, turns the axle of the fore-wheels to the right or left, and thus guides the motion of the vehicle. The machine is nearly completed, and will be brought to trial in a few days.

"Those who have followed us will now have a tolerably accurate idea of this Steam Carriage. It is a stage-coach, with the machinery of a small double steam-engine stowed behind and below it—the water cistern being under the body of the coach, the cylinders and beams in the boot, and the boiler suspended behind the axle. A working rod passing down from the beam to a crank on the axle turns the hind wheels, which, in consequence of the great weight upon them, take a firm hold of the ground, and roll the machine forward. The fore-wheels, which are small, as in the common coach, roll without any application of steam power. Thinking, however, that in steep acclivities, the friction of both fore and hind wheels might be wanted, Mr. Burstall has contrived machinery for transmitting the motion of the hind wheels to the fore ones, which can be applied at any time, and plays idly when not needed. Our conviction is, that this part of the machinery will be found unnecessary, and, as it adds to the expense, friction, and weight, would have been better wanted.

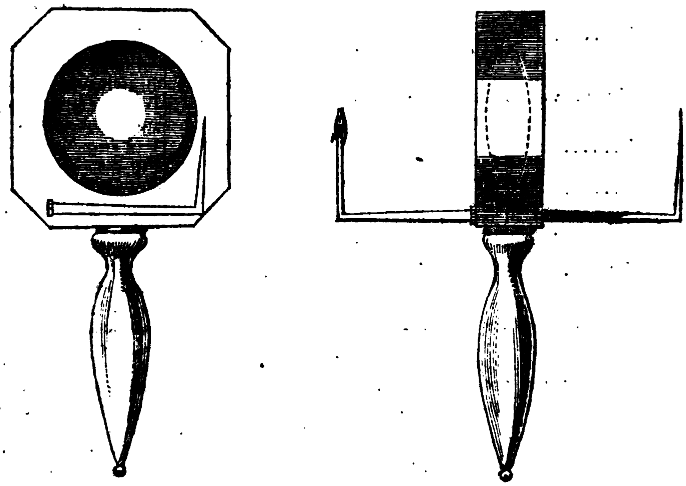
"The common stage-coach weighs about a ton. The machinery in this vehicle, with the charge of water and coals (for a run of twenty miles) will, in the opinion of the engineer, add about a ton and a half; so that the Steam Coach, if loaded with twenty persons and luggage, would not weigh more than three tons and a half; every twenty miles the supply of water and coals will be required to be renewed, but this can be easily done in two or three minutes.

"The engine, as in all the English locomotive machines, is on the high pressure principle. Its power is, of course, variable; but, with a free pressure of 15 lbs. it would be of three *computed* horses power, which would be equal to the efficient for one of seven or eight horses, running at eight miles an hour. This will, probably, be sufficient to give the Steam Coach the usual velocity of stage-coaches. But where the supply of fuel and water constitutes so considerable a part of the burden of the vehicle, economy in the use of these articles is of the first importance. Accordingly, it forms part of the engineer's plan to let more or less water into the boiler, as a greater or less force may be required. In going down a declivity, for instance, the steam will be entirely saved, and in going up an extra quantity will be used. The large wheels, we think, are about four feet and a half in diameter, or fourteen in circumference. Supposing the engine to make fifty double strokes per minute, this would give the machine a velocity of eight miles an hour. If the experiment succeed, the expense of fuel and attendance for an engine like this will be such a mere trifle, compared with the keep of sixteen horses, that the cost of travelling per coach to Glasgow, which is now about fourpence per mile, may certainly be reduced two-thirds.

"Many difficulties arise from the nature of the vehicle that have no existence in the steam-boat, and for which the artist has provided very ingeniously. As the wheels, for instance, move unequally in turning, and may sometimes be required to move backward, they are connected with the axle by a sort of bush with ratchet-work. Some of the pipes are twisted into a spiral, to give them the elasticity necessary to withstand the shocks occasioned by the jolting motion of the wheels on rough roads. He observed, however, that as to steam-carriages moving on common roads, we have nothing but theory to guide us, and that experience will discover defects which no skill can anticipate. The observation is just, and we were well pleased to find that a scheme so difficult was in the hands of

a person whose views were so judicious, and his mechanical resources so considerable. There are a number of contrivances, some of them very ingenious, of a secondary nature, which we have not alluded to. But in looking back over our account, we find we have omitted to mention that the whole apparatus, as well as the body of the carriage, rests on springs, and that provision has been made for stopping or retarding the motion of the machine by an invention (not new), the technical name of which we do not know, but which we would call a friction hoop, clasping the rim of a wheel. It operates very effectually."

WATCH-GLASS MICROSCOPE.



SIR,—Some years ago, I joined two small Watch-Glasses, of the same diameter, in a bason of water, by pressing their edges together with my finger and thumb, so as to fill them completely. When taken out, I was then in possession of a single microscope, whose focal length being 3-16ths of the distance of distinct vision, magnified the surface of an object 25 times. It then occurred to me, that two such glasses cemented together, leaving a small aperture to fill them up with pure spirit, and cased in a small frame similar to the drawing, would form an instrument simple in construction, and excellent as a pocket companion, for the examination of minute objects, such as plants, insects, &c. For the purpose of holding objects to be examined, I place a brass pin, turning on a hinge, in the manner represented, on one side of the frame, and a forceps, with screw, on the other, both of such a length as to set exactly to the focus of the lens. There is a groove on each side of the frame to receive the pin and forceps when not used. One principal object ought to be, to make the frame sufficiently thick to protect the convexity of the glass—a small shagreen case would secure the whole.

I am, Sir,

Yours respectfully,

THOS. HENRY BELL.

Alnwick.

WORK OF STEAM-ENGINES IN CORNWALL.

From a Return of the Work performed by Fifty-nine Steam-Engines employed in the Cornish Mines, for July, 1825, it appears that six of them accomplished as follows :—

Names of the Mines.	Engine and diameter of the Cylinder.	Pounds lifted one foot high, by consuming a bushel of coal.	Remarks.
Wheal Vor......	Trelawney's Engine, 80 inches, single.	43.466.271	Drawing, perpendicularly, 135 faths. and on the underlay 27 fathoms.
Wheal Hope....	60 inches, single.	43.016.888	Drawing all the load perpendicularly.
Herland........	Manor, 80 inches, single.	42.434.527	Drawing all the load in two shafts, perpendicularly.
Ditto..........	Fancy, 80 inches, single.	48.208.950	Drawing all the load perpendicularly.
Wheal Alfred...	Taylor's Engine, 90 inches, single.	47.913.199	Ditto.
Pembroke......	Carlyon's Engine, 80 inches, single.	41.128.238	Ditto.

ADVANTAGE OF THE DOUBLE CYLINDER STEAM-ENGINE.

[We have already inserted, p. 295, vol. IV., an answer to the inquiry on this subject; we select from several other answers the two following, which furnish some useful explanations.—Edit.]

Sir,—Having observed a letter in a late Number of your Publication, requiring information relative to the advantage of applying Steam on Woolf's principle, and calling on any of "the first engineers" for assistance, allow me, through the same medium, to attempt a reply. Although I by no means lay claim to the above rank, "mine being the last of all the families of Benjamin, and I the youngest in my father's house," I contemplate little difficulty in convincing our friend F. J—k—n, that an absolute advantage is derived by such application, which may be clearly demonstrated by practice or theory, mechanics or mathematics.

Let us proceed, and suppose, without entering into minute detail, that we have a single (or double) engine on Woolf's principle, the relative capacities of the cylinders being as 1 to 5 (which cylinders we will designate by *a* and *b*); we raise the steam in the boiler to the pressure of 50lb. per square inch; let us *blow through*, and then apply it to the top of *a*, whilst, at the same time, the valves at the bottom of *a*, and top of *b*, are opened; the steam which was below the piston of *a* rushes into the space above the piston of *b*, and expanding itself into five times the space it previously occupied, is, of course, reduced to 10lb. per square inch, which acts with equal force on the top of *b* and bottom of *a*; therefore the effective force of the steam on the pistons may be stated at 50 — 10lb = 40lb. on *a*, and 10lb. on *b*, by which it is very evident, that a great addition of power is derived from raising steam to a high temperature in the boiler, and employing it in that state before reducing it to a common pressure.

Whatever may be said of the principle, facts are stubborn things; by facts it may be, and is, clearly demonstrated in almost every case in which this plan has been adopted, and I feel assured this engine only requires to be fully known for its more general adoption; reflecting, as it does, infinite credit on the inventor, who, with mighty strides, has trod the paths of science, admirably improved this invaluable assistant, and given to the world the efforts of his genius.

Yours truly,

L'AMI DES MACHINES-A-VAPEUR.

SIR,—In your instructive Magazine, Number 100, a Correspondent requests information relative to Woolf and Edwards's Steam Engines. The writer asks how the steam, after leaving the high pressure cylinder, gains its power to act on the low pressure one? "and further," Will not the steam serving the high pressure cylinder have as much power to resist the return of the high pressure piston, as it will to give action to the low pressure piston?

I answer, if the two cylinders were of the same diameter, the fact would undoubtedly be as it has always appeared to your Correspondent. But this is not the case. In these engines there are advantages, in having the low pressure cylinder eight or ten times the area of the high pressure one. When the steam leaves the high pressure cylinder, it acts with equal force upon the low pressure piston; but there will be a gain of power upon the latter, on account of its additional area.

Let us, for example, suppose two cylinders; the high pressure one 10 inches area, and the low pressure one 100 inches area; the steam leaving the high pressure cylinder of 10 inches, is made to act upon the low pressure piston of 100 inches; and though there is the same resistance against the former as there is action upon the latter, yet it is evident, on well-known principles, there will be a gain of power upon the low pressure piston, on account of its having 90 square inches more to act upon.

I believe these engines work with steam, first, upon the high pressure piston, at a pressure of about 50lbs. upon the square inch; and the first action of the steam upon the low pressure piston will be nearly of the same impetus—I say, the first action, because the pressure will vary as room is made for it to expand, by the ascent or descent of the low pressure piston. When it has expanded into the whole length of the large cylinder, it is by that means brought down to an ordinary pressure, say five or six pounds, upon the square inch (a proper temperature for condensation), which next takes place, and a vacuum produced, on the same principle as in a Watt's engine, by which a further gain of 10lbs. upon every square inch of the low pressure piston is effected, by working the steam over again.

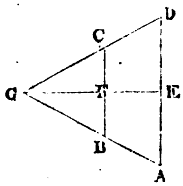
If you think the above will have any tendency to settle the controversy between your Westminster-bridge-road Correspondent and his fellow-workmen, your giving it a place in your useful miscellany will oblige,

Your obedient servant,

EDMUND FEARNLEY.

Shipley, near Bradford, Yorkshire.

NEW IMPERIAL MEASURE.



SIR,—I beg to offer a shorter solution of T. H.'s problem than your Correspondent, Mr. Lake.

Let s = solid required,

$R\,r$, the greater and less radii of frustrum,

$FE = h$, $GF = a$, and $\angle\, DGE = \theta$.

Now $y = x \cdot \tan.\, \theta$ is equation to generating line GD; but, by Differential Calculus, any solid of revolution =

$\pi\, s\, y\, d\, x$ (π = circumference of circle). By substitution, solid $= \pi$. tan. $\theta\, s\, x\, d\, x$, integrating between $s\, c = a$ and $s\, c = a + h$.

$$s = \pi \text{ . tan. } \theta \text{ . } \frac{\overline{a + h}^3 - a^3}{3} = \pi \text{ . tan. } \theta \text{ . } \frac{3\, a^2 h + 3\, a h + h^3}{3}.$$

Now we have $a : a + h :: r : R \therefore a : h :: r : R - r \therefore a = \frac{h\, r}{R - r}$, and tan. $\theta = \frac{r}{a} \therefore$ tan. $\theta = \frac{R - r}{h}$; and, by reduction, $s = \frac{\pi \text{ . } (R^2 + R\, r + r^2)\, h}{3}$.

Now $\pi = 3$ nearly, and $s = (R^2 + R\, r + R)$, &c. nearly.

The above being worked from first principles is, I think, more satisfactory than the former proof.

I am, Sir,
Yours respectfully,
A TINMAN.

STEAM-ENGINE RULES.

(To the Editor of the Mechanics' Magazine.)

Respected Friend,—I have been much gratified by the perusal of your useful publication, but have received greater pleasure from no circumstance connected with it, than from that noble disinterestedness with which men of the same profession communicate their knowledge to each other. No sooner does a mechanic make known his ignorance of any particular subject, and express his desire to be informed, than generally there are several of his brother mechanics willing, and often eager, to give him the information which he requests. I should question if another instance could be found of men so ready to possess their goods in common, losing sight of all emolument and fame, and influenced by the pure motive of benefitting those who are but too often considered and treated as rivals in trade.

In my youth I took great delight in mechanical and mathematical studies; and although I have, for many years, ceased to be a mechanic by profession, I well remember the pleasure with which I imparted whatever I had met with in books, acquired by study, or struck out by my own invention, to all who showed themselves desirous of being made partakers of what I considered a treasure. In those days I contrived many simple and easy rules, either for my own convenience or that of my friends, by which the labour of calculations, often recurring, was greatly abridged, or the operation put within the reach of such as were but little accustomed to apply mathematical investigations to mechanical principles. Some of these, which I have often found useful, and which at present recur to my remembrance, I shall subjoin, that, if you think them of sufficient importance to deserve a place in your Magazine, they may, through that medium, be transmitted to your very numerous class of readers.

1st. To find an equivalent for the power of a steam-engine, expressed in *horse power*.

Let a horse power be equal to 200 pounds, raised at the rate of $2\frac{1}{2}$ miles per hour, as laid down by writers on that subject.

Let a low-pressure engine, with a load of 10 pounds to the inch, work at the rate of 11 strokes per minute, 8 feet stroke. Then multiply the diameter of the piston by its circumference, and cut off two figures from the right hand of the product, we have the number of horses' power exactly.

Example.—Let the diameter of the cylinder be 28 inches, then will the circumference be 88 inches nearly, and $28 \times 88 = 2464$; whence the engine equals $24\frac{1}{2}$ horses' power.

If the engine be supposed to move with the load of 10 pounds to the inch, at the rate of 200 feet per minute, find the power, as before, and increase it by 1-7th part of itself; thus, $24.64 + \frac{24.64}{7} = 28.16$, equal 28 horses' power.

If the engine work at the rate of 220 feet per minute with the same load, find the power as at first, and increase it by $\frac{1}{4}$ part; thus, $24.64 + \frac{24.64}{4} = 30.7$, equal $30\frac{3}{4}$ horses' power nearly.

2nd. To find the load, on the square inch, of an engine employed in pumping water.

Divide 5 times the diameter of the pump by 4 times the diameter of the cylinder; square the quotient, and multiply by 5, and divide by 3 (or annex a cipher, and divide by 6), gives the pounds avoirdupois on each square inch of the piston for every fathom deep, exactly.

Example.—Let a 40-inch cylinder draw a 10-inch bucket 50 fathoms deep.

$$\text{Here } \overline{\frac{10 \times 5}{0 \times 4}}\Big|^2 \times \frac{5}{3} = \cdot 16276041\tfrac{2}{3} \text{ lbs.}$$

which, being multiplied by the depth, gives 8.130, &c. pounds to the inch.

3rd. To estimate the power of an engine working expansively.

Add 1 to the hyperbolic logarithm of the number of times to which the steam is expanded; multiply by the force of the steam, and divide by the number of times to which the steam is expanded, gives an equivalent force, which, acting uniformly throughout the whole stroke, will produce the same effect.

Example 1.—Let the force of the steam first admitted be $17\frac{1}{2}$ pounds to the inch, and be shut out at the middle of the stroke. Then $1+{\cdot}6931472 \times \frac{17.5}{2} = 14.815$, &c. a constant equivavalent force.

Example 2.—Let the steam in a high-pressure engine equal 5 atmospheres (say 75 pounds to the inch); length of stroke 5 feet; steam shut out after the piston had moved 8 inches.

Here $60 \div 8 = 7.5$.

And $1 + 2.0149 \times \frac{75}{7.5} = 30.149$ pounds, or a constant force of two atmospheres.

N.B. If the steam be let off without condensation, there must be 15 pounds to the inch deducted from the equivalent constant force, for the resistance of the atmospheres.

Hyperbolic Logarithms.

No.		No.		No.		No.	
1	0.00000						
1.25	.2231435	$3\frac{1}{4}$	1.1786549	$5\frac{1}{4}$	1.6582280	$7\frac{1}{4}$	1.9810014
1.5	.4054651	$3\frac{1}{2}$	1.2527629	$5\frac{1}{2}$	1.7047481	$7\frac{1}{2}$	2.0149030
1.75	.5596157	$3\frac{3}{4}$	1.3217558	$5\frac{3}{4}$	1.7491998	$7\frac{3}{4}$	2.0476928
2	.6931472	4	1.3862943	6	1.7917594	8	2.0794415
$2\frac{1}{4}$	.8109302	$4\frac{1}{4}$	1.4469189	$6\frac{1}{4}$	1.8325814	$8\frac{1}{2}$	2.1400661
$2\frac{1}{2}$	.9162907	$4\frac{1}{2}$	1.5040774	$6\frac{1}{2}$	1.8718021	9	2.1972245
$2\frac{3}{4}$	1.0116008	$4\frac{3}{4}$	1.5581446	$6\frac{3}{4}$	1.9095425	$9\frac{1}{2}$	2.2512917
3	1.0986123	5	1.6094379	7	1.9459101	10	2.3025851

N.B. The sum of any two or more logarithms is equal to the logarithm of the product or rectangle of their respective numbers, thus, ${\cdot}6931472 + 1.7047481 = 2.3978953$, which is the logarithm of twice $5\frac{1}{2}$, or 11.

4th. To find the weight of a hollow cast-iron cylinder.

To the inside diameter, in inches, add the thickness of metal in inches; multiply by the thickness of metal in inches, and by nine times the length in feet, or three quarters the length in inches; the product (cutting off two figures from the right hand) will be the weight in cwts., reckoning the specific gravity of cast iron to be 7.4.

The same rule will also serve for a circular plate, considering it has a cylinder whose inside diameter is 0, and length the thickness of the plate.

Example 1.—Required the weight of a pump 11 inches diameter within, thickness $\frac{3}{4}$ of an inch, length 8 feet.

Here $\overline{11+.75} \times .75 \times 8 \times 9 = 634.5$; whence the weight $= 6.345$ cwt.

Example 2.—Required the weight of a cast-iron circular plate, 6 feet diameter, and 5 inches thick.

Here, internal diameter $= 0$, thickness of metal $= 36$ inches, length $= 5$ inches.

Then $\overline{0+36} \times 36 \times 5 \times \frac{3}{4} = 4860$, and the weight $= 48.6$ cwts.

These rules I have, very many times, found useful, and to know that they were rendered equally serviceable to others, would confer a pleasure on your friend,

J— L—.

Ichthyotrophia, 9th Month, 1825.

ON THE FRICTION OF CORDS.

Sir,—Professor Leslie, of Edinburgh, in his work entitled *Elements of Natural Philosophy*, page 212, on the Friction of Cords, says, "If the weight balanced a traction of 4 lbs. at the end of a semicircumference, it would balance 16 lbs. at a complete circumvolution.

At the end of two turns . . 256 lbs.
three do. 4096 lbs.
four do. 65536 lbs. &c."

These conclusions are drawn from theoretical investigation, it is to be presumed; but, as no theory is entitled to full credit until it has stood the test of experiment, I shall take the liberty of stating the results of some experiments on this subject, for the purpose of correcting the conclusions above quoted, and to prevent practical mechanics from being misled by such high authority.

1st. I took a cord of 392 feet to the pound, to which I attached a weight of one pound, and applied it to a cylinder of dry ash-wood, turned in a lathe 1.75 inches diameter, and ascertained the force of traction necessary to raise this single pound weight, and found, when the cord was in contact with half the circumference of the cylinder, the force required was............ 2 lbs.
at one and a half turns........13
at two and a half..............31
at three and a half............66

2nd. I then tried, upon the same ash cylinder, another line, very flexible, of 92 feet to the pound, loaded with one pound, as before, and the force of traction observed was,
At half a turn................$2\frac{1}{4}$ lbs.
one and a half turns 10
two and a half 30
three and a half 83

3rd. I next took the line of 92 feet to the pound, loaded with one pound, upon a cylinder of cast iron, rough from the foundry, of 4.5 inches diameter, and found the traction to be,
At half a turn................ 6 lbs.
one and a half 98

4th. Applied the same line to a cylinder of cast iron, turned but not polished, of one inch diameter, and found the traction to be,
At half a turn.................$2\frac{1}{4}$ lbs.
one and a half 8
two and a half............23
three and a half..........56

5th. Upon the same cylinder I tried a new *stiff* cord of 114 feet to the pound, and found the traction,
At half a turn................. 2 lbs.
one and a half 6
two and a half 20
three and a half 39

6th. My next experiment was upon a glass cylinder, of $\frac{.95}{100}$ inches diameter, with the above-named *flexible* line of 92 feet to the pound, and found the traction,
At half a turn................$1\frac{1}{2}$ lbs.
one and a half............3
two and a half............$5\frac{1}{2}$
three and a half..........13

7th. Upon a glass cylinder of ·95 inches diameter (as in experiment 6th), I used the *stiff* cord used in experiment 5th, and found the traction,
At half a turn................$1\frac{1}{2}$ lbs.
one and a half ....$2\frac{1}{2}$
two and a half 4
three and a half ....$6\frac{1}{2}$
four and a half 11

8th. I then applied the line used in experiment 2nd to a glass cylinder of four inches diameter, loaded with the same constant weight of one pound, and found the traction,
At half a turn................$1\frac{1}{4}$ lbs.
one and a half 4
two and a half 9

From the above experiments, when due allowance is made for the stiffness of the cord, and for the weight of so much of the cord as necessarily formed part of the load to be raised, it will, I trust, not be difficult to see that the resistance may be considered as increasing as the second power or square of the number of turns, and not according to the high power assumed by Professor Leslie.

I am, Sir,
Your obedient servant,
B. Bevan.

WHY DOES A RAZOR CUT BETTER AFTER BEING DIPPED IN HOT WATER?

[We insert the following letter, rather for the purpose of inviting discussion on the subject of which it treats, than as approving entirely of the explanations given by the writer. Some of his inferences, we think, will be found illogical, at least.—Edit.]

Sir,—In answer to your Correspondent's (Novaculus) question, "Why does a razor cut better after it has been dipped in hot water?" In general terms, I would say, that as a sheet of sand-paper is cut by a pair of scissars with greater difficulty than a sheet of similar paper, but not sanded. The razor, before being dipped, has obstructions in itself to overcome, but which become removed by the water. This opinion is the necessary conclusion to be drawn from the fact, namely, *that fire causes bodies to suffer loss of elementary matter universally, and communicates nothing whatever to them.* In order to illustrate the case, it is necessary to divide it into two parts, viz. first, as respects fire being hot; secondly, as to whether fire takes from bodies, or communicates matter to them.

First, As to fire being hot, the contrary is the fact—*there can be no such thing in nature as a hot body*, because there is no such thing as an element hot, *sui generis;* and because matter

being inert, is incapable of changing its like from hot to cold, and from cold to hot. *Inertia* implies unchangeableness, as, where there is no power or ability, there can be no change of essence; and therefore heating and cooling unalterable matter, by matter which is inert, is highly irrational to imagine.

In the next place, The means we possess, by which we become acquainted with heat, must convince that fire has nothing whatever in common with heat. Thus, when the hand is applied to an ignited coal, it is not the flesh which feels, as, without nerves, there would be no feeling excited, even were the flesh burnt. Neither do the nerves feel; for, when separated from the brain, and in all other respects remaining uninjured in the body, neither pin nor pincers applied to them can produce sensation. Sensation, then, is confined to the sensorium, which may be the brain—an organ that does not come in contact with the external body, which we suppose hot. Hence it is manifest that heat consists in sensation only, with which what is material can have no similitude, and that it is from imagining the external body to be in a state similar to the sensation that we conclude the body is hot. The term heat, in short, only applies to sensation, feeling, or when health is concerned.

Secondly, Fire takes matter from bodies, and imparts none to them. This is the fact, notwithstanding it is opposed to universal opinion. Wood, paper, linen, damp clothes, fuel, and all combustible bodies, are deprived of matter by fire; so, when indecomposable bodies suffer physical change by fire, without loss of weight, it may be justly inferred that they also have been deprived of matter, although it may be only electric matter; for fire, it will be granted, cannot act otherwise than similarly on all bodies. What fire takes from water is visibly collected on the bottom of vessels before ebullition takes place, in the form of bubbles, that cannot be made to ascend in the water as long as the vessel is in contact with the fire. The denuded state of air, as respects vital matter, in which combustion is carried on—the oxidation, by fire, of metals in air—and the decomposition of water by ignited iron, wherein what the water is deprived of the iron, which is fire, acquires, amounts to a demonstration that fire takes some species of matter or other from whatever may be in contact with or in the neighbourhood of it. And as fire can act but uniformly, that is, cannot draw to it and propel from itself at the same time, it is conclusive there is nothing communicated by it to bodies; and that what is taken for radiation, is the effect of the abstraction which the *air* suffers by fire, or by bodies that have been rendered deficient of some species of matter by fire, by which these act on the thermometer as they have been acted on by fire.

From which it would seem, that the deficient state of the water causes the sated (cold) razor to suffer loss of electric matter, and from the teeth of its saw-edge some of the like, that may be compared to grains of sand or to saw-dust, which, by sticking between the teeth of a saw, prevent it cutting with the same facility as when they are removed.

I remain, Sir,
Your obedient servant,
T. H. Pasley.

INQUIRY.

No. 154.—Art of Turning.

Sir,—I should be obliged to any of your readers to favour an amateur turner with the best apparatus for elliptical turning, and also with the mode of turning cubes with mathematical truth. I am informed it has been done so correctly as to produce a degree of cohesion sufficient to suspend no less than six pounds weight.

I am, Sir,
Your obedient servant,
Turnscrew.

ANSWERS TO INQUIRIES.

No. 145.—Wind-Lathe.

Sir,—If your Correspondent, "E. B." is in the habit of visiting London, he may see a beautiful horizontal mill at Battersea. The sails consist of a large wheel, exactly like an undershot water-wheel, only much longer in the di-

rection of the axis; this is placed with its axis vertical, and is provided with a semi-cylindrical case, revolving about the same axis, the diameter of which semi-cylinder is adjusted to coincide with the direction of the wind. Thus one-half the sails are exposed to the wind, and one-half sheltered, and a rotatory motion is produced.

I am, Sir,
Yours respectfully,
F. O. M.

NO. 134.

VARNISHING STUCCO IMAGES.

Sir,—Having an anxious desire of adding something to the stock of general knowledge, and having observed several answers to your Correspondent Aurum, elucidating various ways of preserving Stucco Images, I beg permission to offer one more method, and that a very simple one, but which none of your able Correspondents have noticed, probably from its simplicity.

I purchased of an Italian, some months ago, the bust of Lord Byron; I kept it until perfectly dry. I trimmed it from all the superfluous marks left from the mould, and then immersed it in raw linseed oil for twelve hours (without any preparation whatever, save the trimming); I then took it out, and drained the loose oil from it: it now has the appearance of yellow wax. When it gets dirty, or fly-marked, it will clean by washing it with a sponge and lukewarm soap and water.

I am, Sir,
Your humble servant,
W. Gilkes.

73, Wheeler-street, Spitalfields,
8th Sept. 1825.

CORRESPONDENCE.

A Correspondent (Tyne), who has lately discovered a Copper Ore Vein, which he supposes will yield 200 tons of ore annually, wishes some of our intelligent readers to inform him, what will be the expense of erecting a Smelting-house, to smelt that quantity of metal, and what would be the expense of smelting it? Coals are to be had in abundance in the vicinity. He would willingly pay any gentleman for proper plans and instructions.

R. H. has favoured us with the following reply to Mr. Hall—(See Correspondence of last week):—

"Sir—My error, in page 309, has served other purposes besides being *amusing*: for one, it has given me a warning to be more particular for the future. I now see the error clearly: how it could escape my notice at the time, is more than I can account for.

"The following, *I believe*, will be found correct:—Take the area of both ends, and a mean proportional between them; add these sums together, and take one-third for the mean area. For instance, from the dimensions given, page 308:—
$18^2 + 6^2 + \sqrt{18^2 \times 6^2} \div 3 = 156 = 13$ feet.

"I was aware of this method when I gave the other; but I imagined that the other came near the truth, and by more simple operations. I erred; I thank Mr. H. for pointing out my error; and I now give you a method not liable to this objection.

"The error of G. A. S. is still conspicuous; and my proof of the erroneous principle on which it was founded will be found correct. R. H."

Mr. Hope will find the information he requests at p. 159, vol. IV.

We thank *Cæsar Borgia* for his different hints. That respecting the *Praxis* we shall very probably follow. His "New System of Fortification" will be acceptable.

A Correspondent, alluding to the "Air Balloon of the 17th Century," says—"I cannot help remarking, that long before the discovery of Montgolfier, the principle and practice of the fire balloon were known in England. There are persons alive now at Ringwood, in Dorsetshire, who remember a doctor in that town that frequently let them off for his amusement, twenty years before ever Lunardi ascended in England. I have heard, too, of similar exhibitions before that in various other parts of the kingdom."

A letter from a Correspondent to "Mechanicus" is left with our Publishers.

G. U. A.'s letter did not reach us till *after* last week's publication. His former paper will appear in next week's Number.

Communications received from—Alpha—Ben Mizen—Lucidus—C. Smith—H. S.—B. P. C.—Amicus—G. H. E.—B. J.—R. R.

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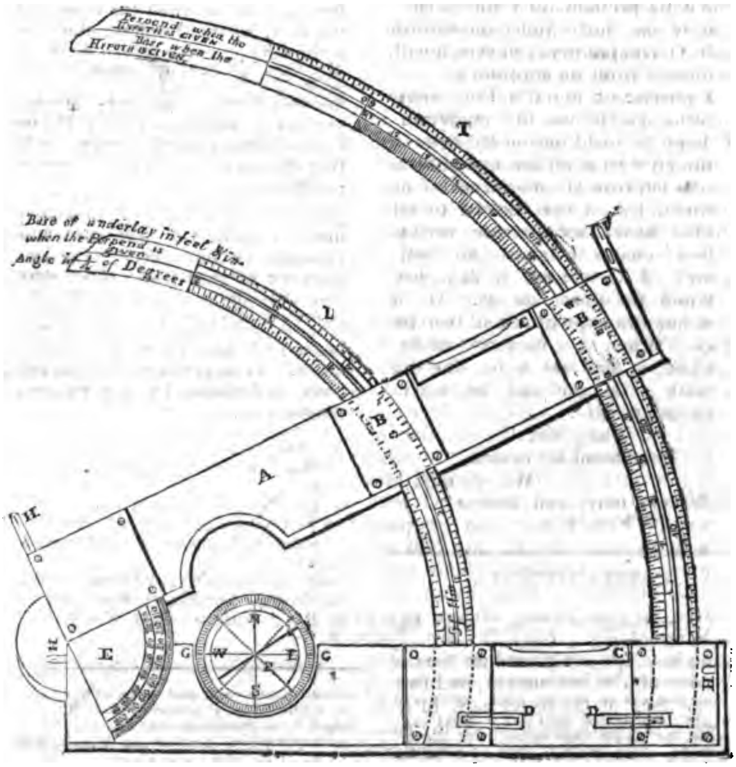
" Sure He that gave us such large discourse,
Looking before and after, gave us not
That capability and godlike reason
To rust in us unused." *Shakspeare.*

ACCOUNT OF THE TRIGONOMETER,

A NEW INSTRUMENT,

INVENTED BY MR. M. P. MOYLEY.

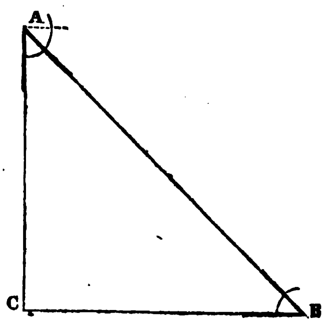


ACCOUNT OF THE TRIGONOMETER, A NEW INSTRUMENT, INVENTED BY MR. M. P. MOYLEY.

SIR,—In January, 1824, I transmitted to the "Annals of Philosophy," some account of an improvement of the Clinometer, then generally in use for some of the operations of mining. It consisted of a quadrant affixed to it, on which was engraven the angle at which the instrument might be opened, and the length of *base* or *underlay* of a stratum or lode to a perpendicular fathom at any particular angle. I at that time stated to Messrs. Knight, of Foster-lane (who manufactured the instrument for me), as well as to many of my friends, that I intended to complete it, by the addition of another quadrant, on which should be graduated the measurement of the remaining sides of a triangle, where one side, and the angle from the perpendicular, were given. I have for some time accomplished this; and the prefixed sketch will, I hope, convey an accurate idea of it. I propose calling it a *Trigonometer;* for it completes the operation of measuring all kinds of triangles with the greatest precision and accuracy.

It consists of two pieces of box-wood, AA, firmly united together after the manner of a rule; each part is 18 inches in length, and half an inch thick; one part is 2½ inches in width, the other 2 inches. To these are occasionally attached two brass quadrants, II; they are made to slide in and out under the brass plates, BB, and may be fixed by the bolts, DD. CCC are three spirit levels, to prove the position of the instrument for various purposes; E is a small quadrant, divided into degrees only, and numbered both ways. F is a magnetic compass, with its scale divided into 360 degrees, also numbered both ways. This compass is hung by an axis, GG, so that it may always swing horizontally. HHHH are four sights; two are placed on the upper edge of the instrument, and two on the face of the lower half, in a direct line with the axis of the compass, and which are particularly useful in surveying, &c. The outer rim of the large quadrant has the angle in quarter degrees engraven on it, and numbered both ways; and when the instrument is open to any particular angle from the perpendicular (say 26½°), the inner rim of the large quadrant gives rather more than 2 feet 11¼ inches for the length of base, or underlay of a stratum or lode, supposing the perpendicular to be one fathom. At the same angle, if the hypothenuse is one fathom, the base would be found, by the outer rim of the second quadrant, to be better than 2 feet 8 inches; and at the other edge the perpendicular will be found to be about 5 feet 4½ inches. The reverse sides of these quadrants are also graduated, showing the hypothenuse when the perpendicular is given, and the hypothenuse and perpendicular when the base is given.

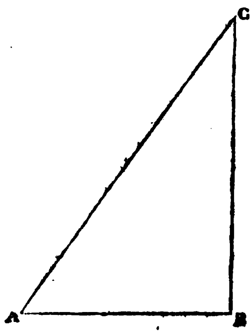
The instrument is graduated, supposing that the radius is in all cases six feet, or one fathom; therefore, if the side or radius given should be two, three, or more fathoms, the amount obtained for one must, of course, be multiplied by that number. Caution should always be had that the angle is taken from the perpendicular; and where the angle is most conveniently observed from the horizon (as may be the case under peculiar circumstances), the complement of that angle (*i. e.* what it wants of 90°) must be used, which will be found to be the same as if the angle were had from the perpendicular. This, perhaps, may be more fully understood by the following diagram:—



If the perpendicular, AC, is one fathom, and it is found, by placing the instrument at A, that the angle, AB, is 40°, it will instantly show that the base, CB, or underlay of AB, supposing it a stratum or lode, will be about five feet and nearly half an inch, while the length of the hypothenuse, AB, will be 7 feet 10 in. nearly. But if the instrument cannot be so placed, but that we can either first place it level, at B, and then, by means of the sights, raise it so as to intersect A, the angle will be found to be 50°. So also would it be if the instrument was placed on the surface of the declination at A, and the other half raised to a level, as shown by the dotted line. In either case the complement of this angle must be used, which will be found to be 40°, as before.

I shall now endeavour to exemplify its utility more fully by a few examples.

EXAMPLE I.

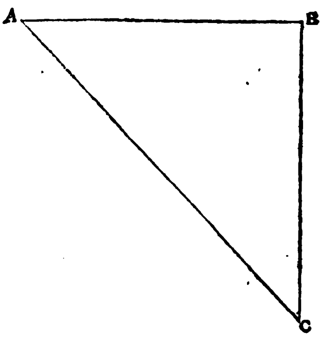


Given, the angle C, from the perpendicular, 25°, and hypothenuse AC, six fathom, or 36 feet; the perpendicular, CB, and base, AB, are required.

	ft.	in.	
Angle 25° will be found to be, for the base..	2	6.42	
Multiplied by		6	
	ft. 15	8.52,	base AB.

	ft.	in.	
Angle 25°..	5	5.25	
		6	
	ft. 33	1.50,	perpendicular CB.

EXAMPLE II.



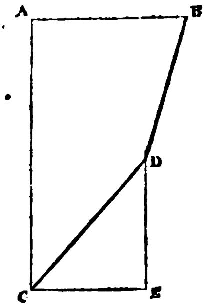
A perpendicular shaft, BC, measuring 48 feet, or 8 fathoms, was found to intersect an underlaying lode or stratum, AC, whose angle of acclivity was 49° 30′; required the length of the hypothenuse, or underlaying lode, AC, and the distance from A to B, or the base at the surface.

Angle 49° 30′.

	ft.	in.	
Comp. 40° 30′	5	1.49	
		8	
	ft. 40	11.92,	base AB.

ft.	in.	
7	10.68	
	8	
ft. 63	1.44,	hyp. AC.

One more example, and I fancy any novice in the art will fully comprehend the extensive application of the instrument.



EXAMPLE III.

Supposing a lode, BDC, should underlay at different angles, and it is desirable to know where or how far from B, a perpendicular shaft must be sunk, so as to intersect the lode at C, and also the depth of C from A; from B to D, being 48 feet, on an angle of 20°, and from D to C 54 feet, at an angle of 40°.

Angle 20°.	Base.	Angle 20°.	Perpend.
	ft. in.		ft. in.
	2 0.62		5 7.65
	8		8
	16 4.96		45 1.20
Angle 40°.	Base.	Angle 40°.	Perpend.
	ft. in.		ft. in.
	3 10.28		4 7.15
	9		9
	34 8.62		41 4.35

Summary of Base.	Summary of Perpendicular.
ft. in.	ft. in.
16 4.96	45 1.20
34 8.62	41 4.35
51 1.58 AB.	86 5.55 AC.

I should hope, from the examples here given, it will be plain that any triangle may be accurately measured; consequently its application may be extensively used for the measurement of heights, land-surveying, and every species of dialling required in the most intricate operations; and I find, from actual experiment, that as much may be effected by its use in one hour, as has been hitherto done by the common methods in twenty-four.

I am, Sir,

Your obedient servant,

M. P. MOYLEY.

Helston, Aug. 1, 1825.

WILLIAM EDWARDS.

One of the most extraordinary bridges in Great Britain is that over the river Taff, near Llantrissent, in Glamorganshire, called in Welsh *Pont y ty Prydd*. This was the work of William Edwards, an uneducated mason of the country, who was only indebted for his skill to his own industry and the power of his genius. He had engaged, in 1746, to build a new bridge at this place, which he executed in a style superior to any thing of the kind in this or any part of Wales, for neatness of workman-

ship and elegance of design. It consisted of three arches, elegantly light in their construction, and was admired by all who saw it. Unfortunately a great flood which occurred drifted down a quantity of timber against the bridge. In consequence of this obstruction to the flood, a thick and strong dam, as it were, was formed. The aggregate of so many collected streams being unable to get any further, rose here to a prodigious height, and with the force of its pressure carried the bridge entirely away before it. William Edwards had given security for the stability of the bridge for seven years; it had stood only two years and a half. Of course he was obliged to erect another; and he proceeded on his duty with all possible speed. The second bridge was of one arch, for the purpose of admitting freely under it whatever incumbrances the floods might bring down. The span or chord of this arch was 140 feet, its altitude 35 feet, the segment of a circle whose diameter was 170 feet. The arch was finished, but the parapets not yet erected, when, such was the pressure of the unavoidably ponderous work over the haunches, that it sprung in the middle, and the key stones were forced out. This was a severe blow to a man who had hitherto met with nothing but misfortune in an enterprise which was to establish or ruin him in his profession. William Edwards, however, possessed a courage and a confidence in his powers which never forsook him; he engaged in the work a third time, and, by means of cylindrical holes through the haunches, so reduced their weight, that there was no longer any danger from it. The second bridge fell in 1751; the third, which has stood ever since, was completed in 1761. The present arch is 140 feet in span, and 35 feet high, being the segment of a circle of 175 feet in diameter. In each haunch there are three cylindrical openings running through from side to side; the diameter of the lowest is nine feet; of the next, six feet; and of the uppermost, three feet. The width of the bridge is about eleven feet. To strengthen it horizontally, it is made widest at the abutments, from which it contracts towards the centre.—*Percy Anecdotes of Industry.*

STRENGTH OF LEADEN PIPES.

[*From the Caledonian Mercury.*]

Some curious and interesting experiments on this point have recently been made by Mr. Jardine, engineer, at the Water Company's Yard in Heriot's Green, Edinburgh, with the view of determining accurately the proper strength or thickness of metal to be given to the pipes intended for conveying water through different parts of the city. This is an important subject, and one regarding which practical men have hitherto been much in the dark. The observations, therefore, set on foot by this distinguished engineer cannot fail to be of great utility, and we hope the particulars of them will be communicated to the public; for it happens in this, as well as in many other branches of mechanics, that a few judicious and careful experiments, in one or two particular instances, are sufficient to comprehend a vast variety of cases which are continually occurring in practice. The strength of pipes, for example, even those of the same thickness of metal, varies greatly with the calibre of each. The pipe, in fact, becomes weaker exactly as its calibre, or internal diameter, is enlarged. Hence it is quite unnecessary to make trials of all the different sizes of pipes, as one good observation of any particular diameter and thickness of metal affords a rule for computing the comparative strength of pipes of any other dimensions whatever. The following are the results of two of the above experiments.

The manner of making the trial is this—the pipe to be tried is closed at one extremity, while the other communicates with a forcing pump, by means of which water is thrown into it and forced, until it presses the pipe on all sides with a violent pressure, in the same manner as if the pipe were conveying the water of a lofty spring, the effect of which is to press out the pipe on all sides in proportion to the height of the fountain-head. But the pump is also furnished with a valve or guage which measures exactly the degree of pressure communicated to the pipe, so

that, in every experiment, we can compute the height of the reservoir which would have caused a similar pressure by the water conveyed from it, and in this manner obtain a rule for adapting the strength of each pipe to the pressure which its situation subjects it to. When the water from the pump first begins to press out the pipe, little or no alteration is observed on it for some time; as the operation of forcing proceeds, however, and the pressure thereby becomes increased, the pipe gradually swells through its whole length, until at last a small protuberance is observed rising in some weak part, which continues increasing until the substance of the metal, becoming gradually thinner and thinner, is at last fairly rent asunder, when the pipe bursts with a crash, and the water issues with great violence. In the first experiment the pipe was $1\frac{1}{2}$ inch bore, and the metal, which was remarkably soft and ductile, was one-fifth of an inch in thickness. This was forced, as above described, until the pressure became equivalent to that of a spring or column of water 1000 feet high, which is equal to 30 atmospheres, or 420lbs. on every square inch of the pipe. This it sustained without alteration, but with a pressure equal to 1200 feet it began to swell, and with 1400 feet, or 600lbs. on the inch, it burst. It appears surprising that the soft material of lead should sustain so enormous a pressure, but this arises from its being equally distributed through every part of the mass. There is no cross strain nor unequal action in different parts of the pipe, but a fair stretch throughout the whole surface, which it is well-known is by far the most favourable situation for strength. On measuring the above pipe after the experiment, it was found to have swelled out from $1\frac{1}{2}$ inch to $1\frac{3}{4}$, so that a part of the original pipe, which had not been subjected to any pressure, could be inserted within the fractured piece. The fracture of this piece presented a very striking appearance. The edges were no way ragged, but quite smooth and sharp, like a knife, showing how the metal had been gradually distended and thinned out to nothing by the internal pressure, as if the pipe had consisted of soft clay or wax. In the second experiment, the pipe was two inches diameter and one-fifth of an inch in thickness of metal: this sustained a pressure of a column 800 feet in height with hardly any swelling, but with 1000 feet it burst. The fracture here was not so fine as in the other, the metal being much less ductile. Such is the extreme pressure which these pipes will bear before bursting, but it would be unsafe in practice to subject them to more than one-third of this. Still, however, it appears that a two-inch pipe, with one-fifth of an inch thickness of metal, will be sufficient for withstanding a pressure of 300 feet. Many other examples might be given of the application of these experiments, did our limits permit. We shall just mention, however, an interesting piece of antiquity, which was lately brought from Italy by Professor Leslie; it is a Roman lead pipe, supposed to have been used in conveying water to the baths of one of the Emperors; it is not truly round, but of an irregular oval or flattened shape, the metal appearing to have been turned over longitudinally, without any roller or mandrel, and then strongly soldered. It is, as near as we recollect, about $2\frac{1}{2}$ inches diameter one way, and 2 inches the other, and the metal about three-fourths of an inch thick. Now, it is evident from the above experiments, that the strength of this pipe is enormously above what the occasion could require, and this shows the advantage of having accurate experiments to direct the construction of such works.

LIGHTING STEEPLE CLOCKS.

The face of a Steeple Clock, illumined by gas, may be rendered equally readable by the inhabitants in the night as in the day; this has now, for some years, been exemplified at the Tron Church, in the City of Glasgow. A gas-lantern, whose exterior (except on the side next the steeple, where it is glazed) tastefully represents the bird called the *phœnix*, is supported at several feet distant from and level with the upper part of the clock-face, by two supports acting braceways to each other, and steadied, laterally, by two chains proceeding from the corners of the steeple: the main of these supports is the gas-pipe, which supplies the lantern, and the other is also a gas-pipe used for lighting the lantern. It effects this by means of numerous equidistant small holes, or narrow cross slits in its side, and is called the *flash-pipe*. At sun-set, when the lantern is to be lighted,

the lamp-lighter, by means of cocks fixed within his reach in the street, turns the gas into both these pipes, and, after waiting a proper time for the gas to ascend to the lantern, he applies his flambeau to the jet of gas issuing from the lowest of the holes in the flash-pipe, the flame from which instantly communicates to the jet next above it, and so on, until in a few moments this chain of flame enters the lantern, and lights the burner of the main pipe, which being perceived by the illumination on the clock-face, the flash-cock is then turned off, and no further attendance is needed until about sun-rise, when the other cock is shut off, and this clock-lantern extinguished, in its turn, with those in the adjacent street. The lantern is curiously glazed, convexly, in five panes; and a number of plane mirrors are, concavely, fixed behind the burner, to act as a reflector in throwing the light principally on the clock-face.

CALCULATION OF INTEREST.

Sir,—In Number 105 of your valuable Magazine, I observe a communication respecting the Calculation of Interest; and from it, it appears, that what was written by your Correspondent, and published in Number 93, was to refute, and not to support, the opinion, that if the product of pounds, multiplied by days, be divided by 365*l.*, the answer would be given in shillings. The idea, that it was a letter in refutation, never crossed my mind; because I knew that the rule (though by no means a short one) was *quite correct*; and, by consequence, I was misled. In that part of his letter which is expressed thus:—365 days : 219 days : : 25*l.* : 15*l.*, I really imagined he was showing, that if 365 *days* were used for a divisor, the quotient would be the answer in pounds, instead of shillings; and which appeared to me to be, what it really is, nonsense. Instead of his proving the fallacy of the rule, as he has imagined, I will prove, and I hope to his satisfaction, that his letter is fallacious; and that, too, very briefly, viz.—365*l.* for one day : one shilling : : 25*l.* for 219 days : 15 shillings.

I observed the trifling omission I had made, in not stating the *rate*; and in my letter, which I wrote, and sent a few days after, containing the 5 per cent. method (inserted p. 339, vol. IV.), I requested that it might be noticed.

Your Correspondent has been pleased (in Number 105) to bring the fractional parts, named by me, to a *common denominator*, and call it a solution of the question! and in the beginning of this letter, he makes an observation upon my remark of reducing the answer from *shillings* and pence, to pounds, shillings, *and* pence, by dividing by 20, there being a misprint of "or" pence for *and* pence.

As a preliminary step to my solution of it, I will inform him, that it is easier to find the interest at 3*l.* 13*s.* per cent. than at any other rate. Now, I believe it is well known, that if any sum, the interest of which is required at 5 per cent. for one day, be divided by 7300, the quotient will be the answer; and at 4 per cent., if by 9125. And I find, upon the same principles, that interest at 3*l.* 13*s.* per cent. is procured by dividing by 10,000.

The difference between 5*l.* and 3*l.* 13*s.* is 27 shillings, and between 4*l.* and 3*l.* 13*s.*, 7 shillings. Let us take the fractional parts of 73 shillings, which, when added, shall be equal to 7 shillings. I shall take for instance (but, of course, many others may be chosen), 1-12th, 1-80th, and 1-17,500dth; and I find that, when these parts are added to 3*l.* 13*s.* the amount is 4*l.* and a very small fraction. Thus, - 73 shillings.

1-12th	=	6.0833333
1-80th	=	.9125
1-17,500dth	=	.0041714, &c.
Shillings	-	80.0000047

As 17,500 appears to be an awkward sum to divide by, if it be quadrupled, the sum will then be 70,000 (which in dividing, &c. is the same, as to trouble, as by 7); but care must be taken to quadruple its quotient.

Now it is evident that if any sum, x, shall be divided by these fractions, and if the quotients added to $x=y$, the proportional *ratio* between x and y will be the same as between 73 and 80.

The 5 per cent. method is founded on the same principles as the foregoing, and is, in my humble opinion, the shortest and most correct that can be devised, viz.—Suppose the interest of 219*l.* for 25 days was required:

219 × 25	=	5475
1-3d	=	1825
1-30th	=	1825
1-300dth	=	1825
		7500 | 75
1-10,000dth	=	75
		7500 | 00=15s.

If any one choose to find the value of these fractions, he may satisfy himself of the correctness of the above. Thus, $x+\frac{1}{3}x+\frac{1}{300}x-\frac{1}{10000}$ of $x+\frac{1}{3}x$, &c.=100 shillings $=\frac{369,863,\ \&c.}{27,000,000}\ \therefore x=\frac{27,000,000.}{369,863,\&c.}$

I remain, Sir,
Your constant reader,
G. U. A.

P.S. I never give myself the trouble to multiply by 20, 12, and 4, to reduce the decimals of a pound to shillings, pence, and farthings; but, *by inspection*, I double the figure next the point for shillings; if the next figure be 5, or upwards, take 5 from it, and add one to the shillings; there the second and third figures are farthings, after deducting 1 for every 25 in them.

BURMESE IMPERIAL STATE CARRIAGE.

The Burmese Imperial State Carriage, which has been captured in the present sanguinary Indian war, has reached this country, and is now preparing for public exhibition. It is said to be, without exception, one of the most singular and splendid works of art that can possibly be conceived, presenting one entire blaze of gold, silver, and precious stones; of the latter the number must amount to many thousands, comprehending diamonds, rubies, sapphires (white and blue), emeralds, amethysts, garnets, topaz, cats eyes, crystals, &c. The carving is of a very superior description, the form and construction of the vehicle extraordinary, and the general taste displayed throughout the whole design is at once so grand and imposing, yet at the same time so chaste and refined, that we are told it may defy all rivalry even from European workmanship. The warlike power and resources of this surprising people are at present exciting universal astonishment and attention: this new object attests the fact that, in taste for design, and skill in execution of works of art, their talents have been equally hidden and unknown to us. The carriage stands between twenty and thirty feet in height, and is drawn by elephants.

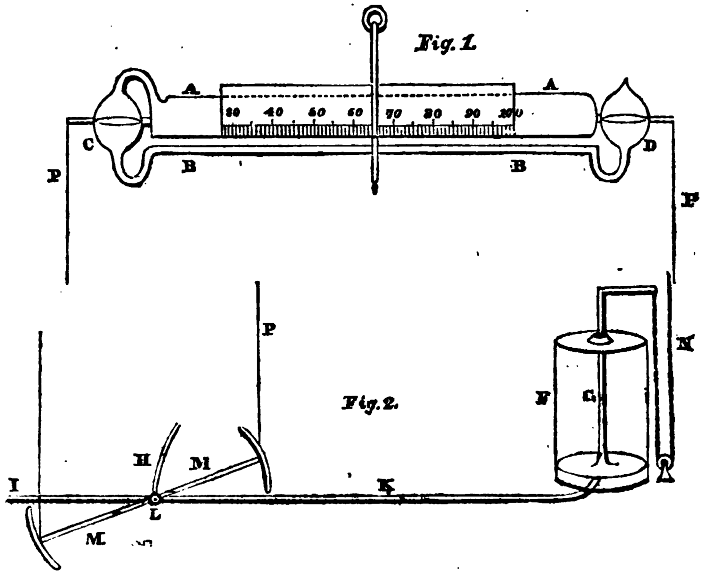
GRAND BALLOON.

Selim Ogal, of Smyrna, has just finished one of the largest Air-Balloons that has ever yet been made: it is 140 feet in diameter, and the parachute 22 feet in circumference, and he intends shortly to make an ascension. Selim will be the first Turk who ever approached so near the regions of their prophet in so frail a vessel.

VEGETABLE TALLOW.

A Vegetable Tallow, extracted by boiling from the fruit of the *Vateria Indica* tree, growing in Canara province and others on the western coast of the peninsula of India, which sells in Mangalore at about 2½*d.* per lb., has lately been brought to London, in a very hard and tough cake, experimented upon by Dr. B. Babington. It is easily made into mould candles, which afford as bright a light as the best animal tallow, and without any unpleasant smell, even when blown out.

MODE OF REGULATING HEAT OF HOT-HOUSES



Sir,—In page 64, vol. iii. of your Magazine, a Subscriber wishes to have a description of an invention for regulating the Heat of Hot-houses; I shall be happy to give him all the information in my power.

AA are a glass tube, from two to three feet in length, hermetically sealed at one end, and united at the other to a capillary tube, BB, with an intervening and also a terminating ball, C and D. The largest tube, and half the intervening ball, are filled with spirits of wine; and the smaller, and half of both the balls, with mercury. The tube is fixed by its centre in a brass frame, E, and nicely balanced. It is evident, then, that every change in the temperature of the atmosphere will produce a change in the position of the centre of gravity of the tubes. One degree of heat, by expanding the spirit, will press on the mercury at C, and drive part of it over to D, which end will, in consequence, descend like the beam of a pair of scales.

In order to apply it to opening windows, valves of chimneys, or flues and steam-cocks, Mr. Kewley, the inventor, uses a metal cylinder, F, from 7 to 14 inches in diameter, and from 18 inches to 2 feet in length, with an accurately fitted piston, G. This cylinder is placed in any convenient situation, and a barrel filled with water is placed on an elevated situation, with a pipe from it, H, to a point directly under the thermometer, and not higher than the bottom of the cylinder; here it joins the pipes I and K; I, a waste pipe, and K, a pipe entering the cylinder below the piston. At the point, L, is a tripartite cock, the handle of which, M, turns only to the extent of one-fifth of a circle; when turned to the right, it opens a communication between H and K; when the pressure of the water raises the piston, and opens the sashes, &c. by the chain, N; when the cock is turned to the left, this communication is stopped, and one opened between I and K, by which the water escaping the piston descends, and the sashes,

&c. are shut. The cock is worked by the wire, PP, fig. 1st and 2nd, joined to the thermometer frame at one end, and to the handle of the cock at the other. It is set to any required degree of heat by the sliding scale, which changes the centre of gravity of the tubes.

A perfect specimen has been exhibited at W. and D. Bailey's, 272, Holborn, since 1818; and the details of construction will be found in the Patent Office, 1816, or the Repertory of Arts for January, 1821.

I am, Sir,

Your obedient servant,

J. L. E.

THE "AIR AND WATER ENGINE."

SIR,—In looking over your 104th Number of the Mechanics' Magazine, I observe a drawing and description of a machine, which your Correspondent (a Member of the Bolton Mechanics' Institute) calls a Water and Air Engine,* from which (per his supposition) he can have power, almost *ad infinitum*, at a very small expense compared with the steam-engine; but I am much afraid that his supposition will be found altogether fallacious. Nevertheless, as he has asked the opinion of others of your Correspondents, I will venture to give him mine. I shall, at present, pass over the first part of his communication (where he says he shall make an air and water engine into eight horses' power by the assistance of a four-horse steam-engine, &c. &c.) and come direct to his question, which is put in so very tangible a shape as makes it quite easy to handle it. It is in substance this:—What number of horses' power will be required to pump water 42 feet high, sufficient to supply two cylinders, each 24 inches in diameter, and making 22 strokes of five feet each per minute? Now, according to this, a column of water 220 feet long and 24 inches diameter must be supplied every minute, and lifted to the height of 42 feet, for the use of his water and air engines. This is no joking matter, I can assure him; and as he wishes to know what power will be required to do it, I will endeavour to inform him.

First, then, $24^2 \times ,7854 = 452,39 \times \frac{2610}{282} = 4235$ ale gallons, and $\times 10,2 =$ 43198lbs. to be lifted 42 feet high, or 1814316lbs. lifted one foot high in one minute; then $\frac{1814316}{33000} = 54,9$ horses' power.

At what power he will estimate his machine, when completed, I do not know; but here we see that it will require no less a power than *fifty-four horses* to lift water necessary to work this air and water engine.

The next thing will be, to try if we can find the power of this machine after water is supplied to it, and in doing this we will allow him the full weight of the atmosphere (=15lbs. to the square inch), and say nothing about the friction of his machine. First, then, the area of the cylinder $= 452,39 \times 15 \times 220 = 1492887$lbs. lifted one foot high in one minute, and $\frac{1492887}{33000} = 45,23$ horses' power; from this it is evident that, instead of gaining power, he will be minus nearly ten horses! The reason of this is obvious, because he pumps his water 42 feet high into the cistern, L (which, by-the-bye, I cannot find in the drawing), and he has only the advantage of 34 feet fall, or, in other words, the pressure of the atmosphere to gain power by. Even if this were not the case, and the water were only raised to the same height as it had to fall, the rising and falling columns would only then balance each other, and he would be minus the friction of the two engines, without still gaining one pound of power.

I would here beg leave to remind your Correspondent, that water cannot be made use of, as a power, to advantage in any other way than by its gravity, and the best application of this is upon the water-wheel. But should he (contrary to my expectation) succeed in convincing himself and me, *that one single pound of power will ever be gained by the air and water engine more than is required to supply it with water*, I then will engage, with great pleasure, to send you a complete plan of valves and working gear, with a mode of governing the said engine.

As I have no other end in view but of giving and receiving instruction, I hope your Correspondent will not find fault with my feeble attempt to undeceive him.

I am, Sir,

Yours respectfully,

A MAN IN THE MOORS.

August 30th, 1825.

HOW TO RESTORE THE COLOUR OF WOOLLEN CLOTHS DISCHARGED BY AN ACID.

SIR,—Having accidentally spilled some strong solution of oxalic acid on a pair of black trowsers, the colour was discharged, and the place, which was large, turned of a yellow colour. The following day I dissolved some pearlash in water, with the addition of an equal portion of *quick* lime, and sponged the part with it. The alkali rendered the stain and the adjacent part, which was wetted, of a dark foxy brown; a little vinegar, now applied, restored all to its pristine black, and I defy the most experienced scrutinizing Hebrew to discover the place.

I remain, Sir,

Your obedient servant,

ALKALI.

SUBMARINE EXPLOITS OF THE HOUSE-SPIDER.

A House-Spider was placed by Mr. Bell on a small platform, in the middle of a rummer full of water, the platform being about half an inch above the surface. It presently made its escape, as was anticipated, by suffering a thread to be wafted to the edge of the glass. Mr. Bell, suspecting it might have been assisted by the water being so nearly on the same level, poured some of the water away, and placed the spider as before. It descended by the stick that supported the platform, till it reached the water, but finding no way to escape, it returned to the platform, and for some time employed itself in preparing a web, with which it loosely enveloped the abdomen, by means of the hinder legs. It now descended, without hesitation, to the bottom of the water, when Mr. B. observed the whole of the abdomen to be covered with a web containing a bubble of air, probably intended for respiration, as it evidently included the spiracles. The spider, enveloped in this little diving-bell, endeavoured on every side to make its escape, but in vain, on account of the slipperiness of the glass; and after remaining at the bottom for about thirteen minutes, it returned apparently much exhausted, as it coiled itself closely under the little platform, and remained afterwards without motion.—*Zoological Journal*, vol. i. 283.

NEW SCARLET COLOUR.

Mr. Badams has recently described a process for obtaining scarlet chromate of lead, and highly recommends its use as a colour either in painting or calico printing. He prepares the scarlet chromate by boiling yellow chromate of lead with potash, and has made several experiments upon the properties of the scarlet colour thus obtained. It appears that it may be made what is termed a fast colour in calico printing, and that it is a durable and beautiful colour when used with oil, possessing considerable body. It is not degraded in its hue by admixture with white lead, as vermillion is; and it also mixes with other colours. As a water-colour it has not been sufficiently tried to render it certain that it will not blacken; but several slips of card and thin paper, painted with it, and hung up in situations likely to affect colour, have not, in some months, perceptibly diminished in brightness. Mr. Badams very justly remarks that, should it succeed, no tint would be a more desirable accession to the pallet than a bright and permanent scarlet, or scarlet orange.

ANNUAL RETURNS OF MECHANICS' INSTITUTIONS.

We earnestly solicit the attention of the Managers and Secretaries of the different Mechanics' Institutions and Mechanics' Book Clubs throughout the kingdom, to the excellent proposition contained in the following letter from our Correspondent, Mr. Harvey. We trust that the national interest and importance of the information which it is proposed to bring together, will make them willing to do every thing in their power to render it as accurate and complete as possible. We

have subjoined to the letter a Form in which the return may be made. It includes columns for two or three matters not mentioned by our Correspondent, but which, we are sure he will agree with us, it is important should also be ascertained. We hope the different returns will be sent to us before Christmas next, when we propose to lay a tabular view of the whole before our readers.

SIR,—It has for some time been an object with me to obtain some authentic account of the number of Mechanics' Institutions, and Mechanics' Book Clubs, now existing in different parts of the country; and it has just occurred to me, that your very useful Magazine might be made the means of obtaining this most desirable information, by introducing a notice, inviting the Secretaries, or other Officers of such Institutions, to forward to the Editor the names of the societies to which they belong. To communicate, however, to such a return all the advantages of which it is susceptible, it would be most desirable to include in it the number of members belonging to each society, the average number of readers which attend the libraries or reading-rooms, the number of volumes of which each library consists, and the rate of the weekly or annual contributions, brought up to some definite period, say Michaelmas, 1825. Such returns, when collected by the Editor, might be tabulated and reduced into a systematic form, and printed in the Mechanics' Magazine; thus affording the materials of much important information, not only to the present generation, but to the historian, whose duty it may be, in after ages, to trace the causes that have operated in accelerating the march of useful information among the working classes. And if annual returns of the same kind could be made, and tabulated according to the best form, the successive steps which mark the growth and extension of mechanical information might be traced from year to year, and from one generation to another.

To your most useful Magazine, dedicated so exclusively in its objects to the diffusion of sound mechanical information among the operatives—the most numerous class by far of our active and enterprising community—the future investigator of the causes of our unrivalled superiority in arts and manufactures will naturally turn, for the materials to assist him in his magnificent survey. Few surveys, indeed, could present more striking and impressive results. It would interest both the philanthropist and the philosopher; it would form a sort of skeleton map of the state of useful knowledge among the operative classes, which every year would tend to beautify and fill up.

For want of authentic information of this kind, if we attempt at any time to trace the causes that have led to results so interesting to human happiness, as are daily presented to our contemplation, we soon become enveloped in uncertainty and error. Let us, however, hope, by the attention that has been latterly awakened to statistical inquiries in this country, that our successors may not have occasion to say of us, what we sometimes have good occasion to say of our predecessors. Let us remember, "that it will equally reflect on the present generation, when they, like the former, shall become the past, unless some means are adopted to furnish our successors with those interesting facts, the want of which leaves us often enveloped in the shades of uncertainty and error.*"

I remain, Sir,

Your obedient servant,

GEORGE HARVEY, F.R.S.

Plymouth, Sept. 21st, 1825.

P.S. The reader is requested to mark with *inverted commas* the 11th, 12th, 13th, and 14th lines, from the bottom of the second column of the Letter in page 315; and also the 19th, 20th, and 21st, and the five concluding lines of the second column of page 316.

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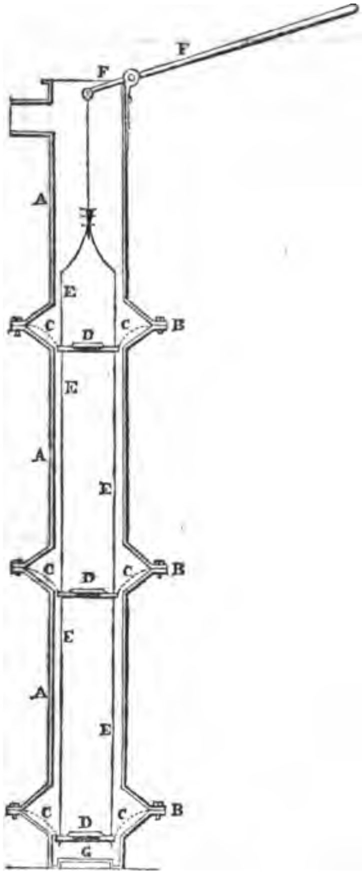
* Wimpey on Economical Registers, vol. i. Manchester Memoirs.

STATE OF THE MECHANICS' INSTITUTION (OR BOOK CLUB),

FOUNDED (*insert here the period*), AT MICHAELMAS, 1825.

Number of Members.	Number of Journeymen or Apprentice Mechanics, who are Members.	Annual & Quarterly Payments.	Amount of Donations (if any) since formed.	Number of Lectures per Week, and the Subjects.	Number of Books in Library of Reference.	Number of Books in Library of Circulation.	Number of Periodical Works furnished to the Reading Room.	Estimated value of Instruments and Apparatus.	Whether managed by Mechanics alone, or by a mixed Committee of Direction.	Remarks.

PISTONS WITHOUT FRICTION.



Sir—The above figure is intended to represent a Section of a Pump, whose pistons, however large, have no friction.

AAA represent the pump, consisting of three distinct cylinders, screwed together by their flanches, BBB, screwing in also leather long enough to descend inside—say here six inches; the other end of this leather, CCC, to be nailed round a piston of wood, having a valve in its centre, D, opening upwards; two or more working-rods, EEEE, pass through and hold each piston, as they move up and down together by the action of the pump-handle, FF. It is manifest, that the leather round the edge of the piston, though only six inches long, will make a 12-inch stroke, because it passes from six inches below to six inches above the junction of the cylinders, whose parts at the flanches are made larger for that purpose, which allows the leather to move freely, and also the capacity of the pump to be increased, without increasing the bore of the other parts. Suppose this pump 18 feet high, and the pistons six feet asunder, then, during the lift, the leather would have rather less than 3lb. pressure to each square inch, because the column of water, 18 feet

high, is divided into three parts, and each piston lifts only six feet; the lower one, near the bottom valve, G, lifts rather more, in proportion to its distance from it. The lower flanch must be air-tight, the others water-tight, these latter being merely water-lifters. I think leather sufficiently pliant may be found that would lift 6lb. to each square inch; in that case the cylinders may be 12 feet long each; however that may be, it is obvious that, by increasing the number of these cylinders and leather-bound pistons, both the height and capacity of the pumps may be increased, without producing any friction; and by making the valve-holes at D large, any floating rubbish would pass upwards, at the moment the pistons were at their highest point, and just opened to return. If the leather were cut out of a whole skin, no sewing together would be necessary.

I am, Sir,

Your obedient servant,

Z.

QUESTION OF SPECIFIC GRAVITY.

If I take a cylinder of wood, lighter than water, and observe, while floating with its axis parallel to the surface of the water, that exactly 3-11ths of the circumference of the cylinder is dry—*Query*, the specific gravity? TRIGON.

INQUIRIES.

NO. 155.—FLAT ROOFS.

SIR,—Can any of your friends recommend a cheap and permanent covering for a *flat* roof?

I am, Sir, yours, &c.

AN INQUIRER.

NO. 156.—RESISTANCE OF WATER.

SIR,—Permit me, through the medium of your valuable periodical, to inquire of your intelligent readers, What is the increased ratio of resistance (according to a given increase of velocity) offered by water, salt or fresh, to a body of a given bulk and shape, passing through that medium, at say, from 1 to 6 feet from the surface?

Let the material be cast iron, the shape a sphere, and the diameter three inches.

Now, if the resistance be 1, and the velocity 1, what will be the ratio of resistance when the velocity is 2, 3, 4, 5, 6, 7, 8, 9, 10, and so forth? and, further, would any other figure than a sphere, or material than cast-iron, commencing with the same relations (1 to 1), give a different ratio of resistance. What would be the difference, and the cause of the difference?

Should any of your Correspondents favour me with accurate information upon this subject, or direct me to a source from whence I may derive it, I shall feel much obliged.

I am, Sir,

Your most obedient servant,

AQUARIUS.

NO. 157.—BRONZE COMPOSITION.

SIR,—Permit me to inquire of some of your intelligent Correspondents, what is the best Composition for what is called, amongst brass-finishers, "Bronze," for giving to brass-work the appearance of real bronze metal, and, at the same time, the proper method of treating the brass-work with it. From the different specimens of work of this kind which I have seen, varying from the perfect black to the light green shade, it occurs to me, that there must be different compositions for producing the various colours, and, probably, different ways of using the compositions. Any information on this (to me) interesting subject will be highly esteemed by,

Sir,

Yours respectfully,

H. S.

Newcastle-upon-Tyne.

NEW PATENTS.

M. Poole, Lincoln's Inn; for the preparation of certain substances for making candles, including a wick peculiarly constructed for that purpose.—June 9.

J. Burridge, Nelson-square, Blackfriars-road, merchant; for improvements in bricks, houses, or other materials, and for the better ventilation of houses and other buildings.—June 9.

J. Lindsay, of the island of Herme, near Guernsey; for improvements in the construction of horse and carriage ways of streets, turnpike and other roads, and an improvement or addition to wheels to be used thereon.—June 14.

W. H. James, Coburg-place Winson-green, Birmingham, engineer; for improvements in the construction of boilers for steam-engines.—June 14.

J. Downton, Blackwall, shipwright; for improvements in water-closets.—June 18.

W. Mason, Castle-street, East, Oxford-street, axletree-manufacturer; for improvements on axletrees.—June 18.

C. Phillips, Upnor, Kent; for improvements in the construction of a ship's compass.—June 18.

G. Atkins, Drury-lane, and Henry Marriott, Fleet-street, ironmonger; for improvements on, and additions to, stoves or grates.—June 18.

E. Jordan, Norwich, engineer; for a new mode of obtaining power applicable to machinery of different descriptions.—June 18.

J. Thompson, Vincent-square, Westminster, and the London Steel Works, Thames Bank, Chelsea, and John Barr, Halesowen, Birmingham, engineer; for improvements in producing steam applicable to steam-engines, or other purposes.—June 21.

T. Northington, the younger, and J. Mulliner, both of Manchester, small-ware manufacturers; for improvements in the loom or machine used for the purpose of weaving or manufacturing of tape, and such other articles to which the said loom or machine may be applicable.—June 21.

Ross Corbett, Glasgow, merchant; for a new step or steps to ascend and descend from coaches and other carriages. June 21.

P. Brookes, Shelton, in the Potteries, Staffordshire, engraver; for improvements in the preparation of a certain composition, and the application thereof, to the making of dies, moulds, or matrices, smooth surfaces, and various other useful articles. June 21.

NOTICES TO CORRESPONDENTS.

An Amateur says, that if "D. J. (Inquirer 144) will describe the intended application and use of the Lens he wishes to grind, he will endeavour to give him the information he requires." "In the meantime," he adds, "I shall be glad to be informed if there is any book to be got which gives a description of the construction of Telescopes of all kinds, and which treats of their sizes, magnifying powers, uses, and qualities, as compared with each other; with historical remarks on some of the most famous that have been made, as well as on the makers. Dr. Kitchiner has long promised something of this kind; and should this meet his eye, I hope he will favour me, and your readers in general, with his intentions on that subject, and let us know how long it will be before it be published, as I have several friends who are anxiously expecting it, and who, with myself, will take a copy each."

The request of our friends at Cardigan shall be complied with.

H. H. H. will find that water alone, and water colours, are sufficient.

"An Old Toper" cannot do better than put his plan into practice. We think it good, and shall be glad to know the result.

Communications received from—Robert Edwards—Ikey Pringle—C. Y. J.—Libra—Philarchus—A Member of a Mechanics' Institution in Kent—D. P. S.—B. B.—Nemo—An Old Horse—John Simpson—Rachel—P. R. E. S.

⁎ *Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills*, *Jowett*, and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

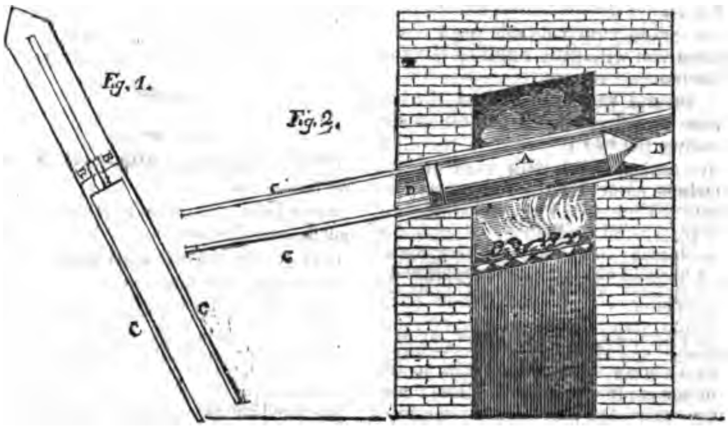
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 111.] SATURDAY, OCTOBER 8, 1825. [Price 3d.

"Hath God endued thee with wisdom? Hath he enlightened thy mind with the knowledge of truth? Communicate it to the ignorant for their instruction—communicate it to the wise for thine own improvement."—*Dodsley's Economy of Human Life.*

MR. PERKINS' STEAM ROCKET ENGINE.



SIR,—The following is a description of the new mode of firing rockets (by steam), invented by Mr. Perkins, for which he has obtained a patent.

Fig. 1 shows a section of the rocket or hollow vessel (made of wrought iron), which is to contain the water. A piece of iron, B, is screwed into the end of this vessel, having a small aperture or bore extending through it. To this piece the tail of the rocket, with the guide-rods, CC, in lieu of the usual rocket-stick, is attached; and the vessel being completely filled with water to a short distance up the aperture or bore, a plug of brass is to be driven into the bore, which confines the water within under considerable pressure.

The rocket is now to be placed in the furnace, as shown at fig. 2. A cylinder, DD, made of cast-iron, and open at both ends, is to be built into the furnace in an oblique direction, for the purpose of receiving the rocket; which cylinder, becoming red hot, will communicate its heat to the rocket placed therein, and when the heat has caused the brass plug (which closes the bore of this pipe, *b*) to melt, the force from within will drive it out, and the water also, which, immediately flashing into steam, will cause the rocket to be propelled forward in the direction of the cylinder, DD, which is its guide. The plug may be made of other metals instead of brass, or such alloys as will melt at given tempera-

tures: the object of this is, that the force of the steam, by which the rocket is propelled, may be under control, and capable of regulation by the employment of metallic plugs of different fusibility.

I am, Sir,
Yours respectfully,
R. Lewthwaite.

P.S. The patentee states that this invention is applicable to the discharge of a great variety of projectiles, but, as the principle is the same in all, he has thought it necessary only to describe the mode of adapting it to the discharge of rockets.

CHIMNEY SWEEPING.

Sir,—The subject of Sweeping Chimneys without Boys, having been noticed in your valuable pages, perhaps you will give room to the following.

Several years ago, when the Society was first established for superseding the use of boys, I travelled in a stage coach with a gentleman (whose name I have forgot, but he was a Captain in the Westmorland Militia, and resided at Haslemere, in Surrey), who gave me an account of a machine he had invented for sweeping chimneys without boys, which, he said, answered most completely. He stated, that chimneys in London were built pretty nearly of the same dimensions. He therefore provided four brushes, made of short strong hair, such as scrubbing-brushes, of the size of the four faces of the chimney. On the back of each of these brushes was fixed a spring. The four brushes were then fastened together, hair outwards; they were supposed to fit the chimney. To this machine was fixed a rope, which passed over an iron bar placed on or near the top of the flue, by means of which the brushes could be pulled up and down the chimney till it was cleaned. If there was any accidental obstruction in the chimney, or it was narrower in one place than another, the springs permitted the brushes to be compressed; and when it widened, the springs always kept the brushes close to the faces of the chimney. When the chimney was thus swept, the brushes were taken off, but the rope remained in the chimney; and, for security, he recommended a chain, of three or four feet long, to be put to each end of the rope.

He presented a model of this machine to the Society, but it was rejected, because it did not work wholly from the bottom, which the Bishop of Durham, the Chairman, said was a *sine qua non*. The inventor was asked if he knew how many iron bars must be put upon chimneys in London? That alone, said the Bishop, is an objection to this plan.

The Captain said, that he took back his model; but that he had constructed the machine, and used it in his own house with great success.

I am, Sir, yours, &c.
Cumbriensis.

BORING.

Sir.—Northumberland is the land of holes, and we learn to bore here in our infancy. The machines described in the Mechanics' Magazine, invented by M. Monnom and J. M., would do well enough if the earth was made of "chalk or cheese," but, unfortunately, it is full of great stones; and in boring in mines (which is the *ne plus ultra* of the art) we have to pierce through numberless hard strata, some of them 20 feet thick, so hard, indeed, that the machines above-mentioned might be turned round until doomsday without drilling through them. Your Correspondents do not seem to understand how these hard materials are cut through. It cannot be done by turning the rods round and round, however great the weight that presses them down: they are armed with a chisel, and by being lifted up and let down in a quick alternate manner, their weight acts like a hammer upon it, and thus cuts the stone. Some beds are so exceedingly hard that they cannot be cut even in this manner, but the rods have to be driven by a hammer, which is a very tedious

operation, as their great length and weight blunt the force of every blow. In boring through whin, &c. at a great depth, two inches is sometimes a good day's work! Your ingenious Correspondents will see of what little importance a machine to turn the instrument round will be in a place like this. If they can discover a method to *jolt* or *beat* with the rods better than can be done by the hand, or how to make them, when long, drive as easily as when short, they will do a great service to the public.

I wonder what kind of metal J. M. makes his augers of to bear two men turning with a cross-head "15 or 20 feet long?" The augers here are frequently *broken* with a head not more than *three feet long*; and to break one in the hole is a great misfortune, as it seldom can be got out, and, of course, prevents the hole from being made any deeper.

I remain, Sir,
Your very obedient servant,
JOHN WELCH.

Newton, near Alnwick.

ON NAVAL IMPROVEMENT.

BY COLONEL BEAUFOY, F.R.S.

[*From the Annals of Philosophy.*]

The building of three experimental vessels for the improvement of naval architecture having excited much attention in the public mind, not only from the peculiarly interesting nature of the science under inquiry, but from the professional abilities of the different projectors, the individual success of each ship has been observed with an anxiety commensurate with the importance of the object in view.

If, notwithstanding the skill of the constructors, neither of these men of war showed decided superiority in sailing, the failure must be attributed to our ignorance of the resistance bodies meet with when opposed to the impulse of water. Our knowledge of this branch of physics is nearly as limited as our acquaintance with the laws which govern the motion of the fixed stars; but here the parallel must end: the accumulated industry of ages alone will probably detect the cause which produces change of place amongst these heavenly bodies, whereas the advancement of hydrodynamics is within the influence of the present generation.

If strength, durability, and efficiency, be all that is required in our floating fortresses, these characteristics have already been combined by the talent of Sir Robert Seppings.

It appears that much uncertainty existed in the sailing of the experimental vessels: sometimes one had the advantage, sometimes another; the distinction resting mainly on the quantity and stowage of the ballast, alterations in the masts, yards, &c. The requisiteness of these changes is a proof that the highest genius is incapable of correctly anticipating either the qualities or the sailing powers of a ship prior to her going to sea.

One great point has been gained by building these vessels, in showing that the synthetical process is inadequate to obtain the end in view. Is it not similar to a chemist, who, desiring to analyse metals, of which some were known and others unknown, first mixed them altogether, and then, after great pains, labour, and expense, discovered the impossibility of arriving at any accurate conclusion in regard to their respective properties; whereas had he, in the first instance, separately examined each, the result would have proved less fatiguing, less costly, and more satisfactory? In all complex cases, scientific or mechanical, the most easy and natural way for well understanding the subject, is to resolve it into the component parts.

In the construction of ships, the great and leading features are stability and fast sailing; the theory of the former is sufficiently known, but our acquaintance with the resistance of non-elastic fluids may be termed yet in its infancy. The ablest builder is at present ignorant of the curves best adapted for dividing the water;

and working thus in the dark, it is no wonder that the aggregate of slow sailers so far exceeds those that are fast.

The importance of discovering the curve of least resistance is not confined alone to vessels moved by the power of wind. Constructors of steam-boats are deeply interested in the fact. If a packet with an engine of forty-horse power be driven nine knots in an hour, it will require an effort of nearly sixty-one horses to increase the speed to ten. Could this additional mile be gained, by giving the hull a more advantageous form for cleaving the water, many substantial benefits would accrue. The original cost of the engine would be lowered from the inferior size required, expenditure in fuel and stowage would be saved, and less risk incurred of the melting of the grate bars. In short, from the waterman who plies upon the Thames to the captain commanding the largest ship in the British navy, all are interested in finding the solid of least resistance; the first by diminishing the labour of the oar, and the latter by out-sailing, coming up with, and capturing the enemy's ship.

Ships have been aptly compared to bridges connecting the whole world together; a slow-sailing vessel, therefore, is a bridge longer than necessary. It is not improbable that the Carthaginian and Roman builders surpassed the moderns in the form they gave their men of war for cleaving the water, because, being frequently impelled by oars, to lighten the fatigue of the rowers, must have been a matter of the greatest moment.

It is highly gratifying to observe the pleasure that several of the nobility and gentry take in maritime concerns. The Royal Yacht Club, by building vessels, and bestowing prizes on the best sailers, enjoy the patriotic and praiseworthy consciousness, that money so expended encourages some of the most useful classes of society, and creates a spirit of emulation among the different branches of artificers connected with nautical affairs. This institution, by introducing for trial new and expensive machinery, is capable of performing services which few individuals could undertake; and it is submitted for the consideration of the body, whether considerable improvement in the science of sailing might not result from the following experiments.

Lug-sails are usually thought preferable to others in turning to windward, and such as are taunt and narrow are deemed more effective than those that are low and square; but this phrase of taunt and narrow is extremely indefinite. In the first instance, it is proposed that a vessel, rigged as a lugger, shall sail with others, and most likely one amongst them will be found either a company-keeper, or whose rate is nearly on a par. In the next place, let canvas be taken from the breadth of the sails and added to the hoist, and a second comparison made; thus subjecting the sails to repeated alterations and trials, until the maximum of the length to the breadth be obtained. This fact established, the next suggestion is, to convert the lugger into a cutter, observing the necessary precaution, that the mainsail, foresail, and jib, expose the same surface to the action of the wind as the sails of the lugger. The third trial consists in changing the same vessel into a schooner, scrupulous regard being paid that the quantity of sail is equal in the three cases, and that no variation in the weight, quantity, or stowage of the ballast, be permitted either in the boat of comparison, or experimental vessel.

Rigid adherence to these points is essential to the success of the experiments, inasmuch as it is the action of sails, and not the best trim of the hull, which forms the object of the present inquiry. A vessel of size is for several reasons desirable; one of 14 feet beam, and 57 on deck, might prove sufficiently large; but the beams of the deck should be so disposed as to require no removal in the subsequent alterations of the masts for the various modes of rigging. It is also recommended that

the body be clencher-built; vessels so constructed generally excel in sailing such as are carvel made, and this superiority will obtain so long as the resistance of water to curved lines shall be involved in obscurity.

It is somewhat paradoxical that constructors of boats for contraband trade should possess such decided advantage over the builders employed by the revenue, as to call forth an Act of Parliament, regulating the extent and the fixing of the bowsprit, and limiting the proportions which the breadth of a vessel must bear to its length. Such legislative interference is detrimental to science: experience teaches us, that attempts to run goods will continue so long as high duties create the temptation; and the boat restrictions, instead of mitigating the evil, have but caused the removal of the capital and skill of the constructors from our own coasts to those of Holland. If a smuggler build a lugger 13 feet beam, 96 from stem to stern, and the bowsprit 60 feet long, why not launch a custom vessel of 100 feet in length: the smuggler, if chased, would use his best endeavours to escape; the revenue officer, actuated by duty and stimulated by hope, would exert his utmost to make a seizure, and the relative success of either party would soon determine the most effective limits of length to breadth.

Let not these remarks be misconstrued into an advocation of illicit trade. Taxes must be raised, and consequently any person who by smuggling evades paying his individual share, commits a fraud on the rest of the community, by binding on others the obligation of his own debts. My sole wish is, that naval science may not be injured by legal enactments. On the same principle that laws are made for building and fitting of vessels, why should not others pass, restricting residents on the coast, suspected of contraband addictions, to the services of none but lame horses; whereas all such as are fleet should be devoted to the use of those engaged in the collection of the revenue.

NUMBERING OF HOUSES.

Sir,—Encouraged by the favourable notice which I perceive a communication inserted in your 97th Number has obtained, respecting the new London Bridge, I take the liberty to suggest what I think would be an improvement on the method at present pursued, of Numbering the private Houses in this Metropolis. I more particularly allude to the new streets which are now in progress, both in the city and its suburbs; and though I cannot but be aware, that it is a far less important subject to the inhabitants of London generally, than that above alluded to, yet I think you will acknowledge, that it is not a matter of total indifference to that portion of the public who are only occasional visitants.

I doubt not that some of your readers, who, like myself, reside in the country, have sometimes experienced the difficulty of finding any particular house in the streets of London, without knowing on which side it may chance to be situated. After walking, perhaps, the whole length of a street, we have discovered that it must be on the opposite side, but which it was altogether impossible to have observed before, owing to the obstruction of carriages, or other local causes. Although attended with no greater inconvenience than mere fatigue, this is an evil which it is very desirable to obviate.

The plan which I would propose, is that which is adopted in the cities of the United States,* and is as simple in theory as it is useful in practice. It is merely to have *all the odd numbers on one side*, and consequently the even ones on the other; so that a person can at once tell on which side the number sought is to be found. For instance, we will suppose No. 1 to be a corner house, No. 2 is then the opposite house; No. 3 is next to No. 1, and No. 4 adjoins No. 2, &c. and so on regularly to the end of the street.

An Anglo-American.

* And also in some of the streets of Edinburgh.—Edit.

NEW SHIPWRECK SAFETY-MACHINE.

An article from Haerlem notices, but very indistinctly, an experiment made at that place with a machine of the singular title of the *Sea Phander*, which appears to be applied by means of a horse, which, advancing with the machine towards a vessel in distress, conveys ropes to the crew for their preservation. The experiment is said to have been successful.

DIFFERENCE BETWEEN HEAT OF FLAME AND HEAT OF NON-LUMINOUS MATTER.

SIR,—The study of a poor man, and of a mechanic in particular, should commence with first principles, and the contemplations of the mind will be rendered clear, agreeable, and practical, in the degree that accurate knowledge of first principles may have been established.

Solomon, the wisest man, asked for wisdom and knowledge, and the Supreme Ruler added in his grant riches, wealth, and honour. Sir Isaac Newton, the greatest of philosophers, had a character peculiar for mildness, industry, and affability; and relying upon the discovery of first principles, attained honour, power, and affluence, although early educated only at a grammar-school at Grantham.

I will, therefore, take this opportunity to repeat a correction of the impression given by our philosophers, that the transmission of solar heat is not interrupted by glass, while that of terrestrial heat is entirely impeded.

M. Brande has lately explained the source of error—that the heat of flame resembles solar heat, but that the heat of matter, not luminous, is incapable of penetrating glass.

The application of this knowledge is important on a subject occupying many of your pages, viz. the economy of fuel in the furnaces of steam-boilers. The superior power of flame heat can be proved by the fact, that a manufacturer, during a long winter, used some coke; but as it produced no flame, it was found entirely useless.

Upon this principle I will conclude, by requesting to know, whether the decomposition of water or steam, applied to aid the combustion of coals, and produce flame, would not give considerable advantage, although the elements of water must be first separated by heat, and exposure to the coals in the furnace;* and, particularly, whether the coke, and substances burning *without* flame, may not thus be made to burn *with* flame?

Every mode of producing flame—of causing economy, by giving the greatest approximation and extension of flame towards the boiler, must be very important; and it is only necessary to observe of flame, that it should not be drawn, like that of a blow-pipe, to impinge on one point, as it speedily destroys the boiler, without producing concomitant advantages.

First principles point out the way we should go, and the proper exercise of industry gives a peculiar vigour of mind and saving knowledge in all we undertake; which, that you and your readers may long live to enjoy, is the wish of

Your very obedient servant,

TYRO.

ASCENDING AND DESCENDING HYDROSTATIC CARRIAGE.

A Mr. George F. Reeve, of Orange county, New York, has constructed an engine, which not only exhibits an eccentricity of ingenuity in the inventor, and a pleasing novelty to

* Steam has been recently applied in this manner, with an advantage of 50 per cent., by Mr. Evans, of Bread-street, Cheapside; but his claim to the first honour of such an application is disputed by Mr. Gilman, and (we believe) by some other individuals. We suspect that the Americans can put in a better title to the discovery than either the one or the other. It is several years ago since the seeming paradox of *burning water* cut a prominent figure among a number of American wonders newly imported. We intend shortly to give a description of Mr. Evans's apparatus for the purpose.—EDIT.

the beholder, but bids very fair to become extensive in its practical utility to the community; the design of the engine is to transport goods or articles by aid of water, any distance, where there is a sufficient quantity and fall for any given distance. Its leading principles consist of a wheel and axis, with floats or buckets, adapted to a race or trough, whose angle of incidence is adapted to the fall, or other circumstantial conveniences. Upon each end of the axis of this wheel is a cog wallow wheel, which works into a rack or cog plate, which is placed upon the top on each side of the race, and which answers for what may not be improperly termed a railway. The engine being situated at the foot of the race, and the water let in, and operating upon the floats, turns the wheel, and by the wallow cog wheels of the axis of the water wheel being geered with the rack on the race, the wheel ascends; and by a more or less partial supply of water, the water-wheel is made to descend with the velocity required. To the engine may be attached any formation or construction of a carriage, adapted to the nature of the articles intended to be transported. —*Philadelphia American Daily Advertiser.*

NEW PRINTING PRESS.

I stated some time ago that I had completed a small steam-press, or a press to work with lever power, and with sufficient rapidity to produce 2000 impressions per hour, but could not discover a satisfactory mode of supplying my ink-rollers, and solicited the co-operation of some of my Yankee brethren. A Mr. W. H. Hale, who comes, I understand, from Boston, and is a silversmith, called upon me, and soon removed the difficulty, by the formation of an ink-trough, which, supplying one roller, communicates the ink rapidly to the other roller, and after a short time, my model was complete, and is so simple and efficacious, and works with so much ease, that 2500 impressions may be thrown off in the hour, by the introduction of a heavy fly-wheel. The press is worked by a crank, and with the labour of one hand and two boys to feed the cylinder with paper; thus superseding the necessity of steam, water, or horse power.—*Noah's American Advocate.*

IMPROVED HARNESS MACHINE.

In the present scarcity of draw-boys, it gives us great pleasure to announce, that Claud Wilson and Alexander Lang, weavers, George-street, have made a most important improvement upon the French harness machine, which in many respects will be of the utmost advantage to the trade. The French machine costs 15*l.* for a harness 400 of a tye; whereas one upon the new principle can be procured for 5*l.*, and of 200 of a tye, for 4*l.*; the treadle in the former requires to be pressed down nine inches, in the latter only 4½. The web which has been selected for a trial is a common imitation shawl; but the inventors are confident that they will be able to work a shawl, plaid, or trimming, with three covers, with one-half of the cards that are required upon the French plan. The machine has been examined by a number of manufacturers, weavers, and mechanics, who have all expressed themselves highly satisfied. It is open for public inspection, and may be seen by applying at No. 139, George-street.—*Paisley Advertiser.*

MR. SPILSBURY'S PATENT METHOD OF TANNING.

We have pleasure in being enabled to gratify the wishes of many inquiring Correspondents, by the following description of this new method of Tanning:—

For Mr. Spilsbury's method of tanning, oblong square frames are provided, with metal hoops fastened round their edges. On one of these a skin or hide is stretched, after being limed, cleansed, and prepared in the usual manner for tanning. Over this hide another of the frames

is placed, then a second hide is laid above it, and a third frame is put above that. The three frames are arranged so that the metal loops of each shall be opposite those of the others; screw bolts are then put through those loops, and screwed up sufficiently tight to prevent any liquor from passing between the frames and the hides. The whole is then set up edgeways, and there being two short pipes, furnished with cocks, in the upper edge of the middle frame, a pipe, in which there is also a cock, that descends from a cistern holding tan liquor, is fastened to one of these by a union joint; and another cock being placed near the bottom, in the same frame, to let off the liquor when required, completes the whole apparatus.

The cock at the top, that communicates with the tan cistern, being opened, and the other near to it being also opened, while that at the bottom is shut, the tan liquor will run down between the hides, driving out the air at the other open cock; which, as soon as any liquor appears in it, being shut, the tan liquor will then distend the hides, and press outwards, with a force proportional to the height which the tan cistern is elevated above the frames. The consequence of which pressure will be, that the tan liquor will ouse through the pores of the hides, appearing at the outside like dew; and by thus bringing fresh portions to act continually on them, will, in the opinion of the patentee, cause them to be tanned much more speedily than happens in the common method, in which the hides lie in the liquor, after it has ceased to operate on them, and are only passed into fresh liquor at intervals by a tedious manual operation.

The frames are to be made of wood or copper, and if iron should be used for them, it must be well painted, to prevent its making the hides black.

In some cases, two skins or hides may be put at each side of the middle frame; and when the whole are well tanned, the tan cock is to be closed, the liquor is to be run off at the lower cock, and the frames separated from the tan pipe and from each other; and the hides being removed, and having their edges pared off, which were nipped or compressed between the frames, are then to be dried and finished in the usual manner.

Nothing further is stated in the specification respecting the time which this process will require, but that it must depend entirely on the nature of the hides or skins.

The New Repertory of Inventions has the following remarks on the value of this process:—

"This method of tanning has attracted much attention; and it is reported that hides of that thickness, to require a year for tanning in the common method, can be finished in this in six weeks; and that some skins can be tanned by it in eight or nine days; it is also said, that a very large sum of money has been offered for the patent right.

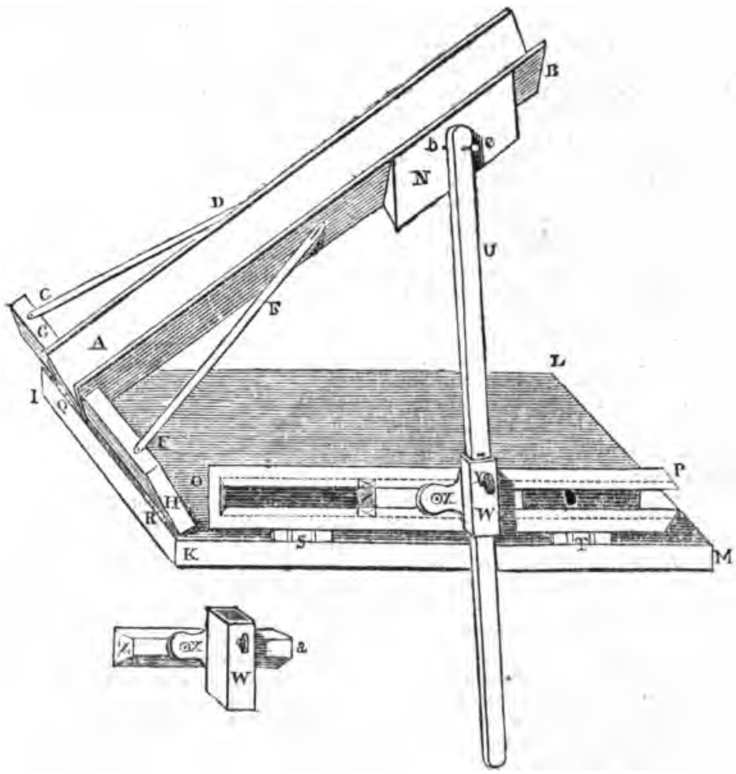
"The theory of the process appears to promise well for quick performance, but on these occasions it is necessary to attend to facts; and we have been informed by some gentlemen in the trade, that the hides are not tanned evenly by this method, but leave spots less acted on by the liquor than the rest; and that leather made in this way is not so durable as the common sort.

"The quantity of the hides that must be pared off when they come out of the frames, must certainly diminish the value of the process, and especially when oblong-square frames (such as are represented in the figures of the specification) are used, which, not being of the natural shape of the hides, must cause more waste; which must be worth consideration, even though the parts to be cut away are the least valuable of the hides.

"It must, however, be considered that this method of tanning is still in its infancy, and that it will be probably improved in time, so as to diminish some, and totally remove others, of these objections made to it.

NEW TELESCOPE STAND,

CONSTRUCTED BY MR. W. SHIRES, MATHEMATICIAN.



DESCRIPTION.

Let KL be the base of the stand, to be placed on the top of a pedestal parallel to the horizon, by the side of which the arm, NU, is to act.

AB is a trough to contain the telescope; at its end, A, a piece of plank or board, GH, is made fast, and is fixed to the base by two hinges, E and R. Near the top of the trough, the arm, NU, is so fixed, by an extended pin, *de*, as to play in diverse directions. The arm, NU, is to slide in the tube, W, and to be made fast at any desired part by turning the screw at Y until it presses against the arm, and by this means you will fix it very nearly to any desired altitude.

Now one side of the tube, W, being made to project, and a hole, X, made through it for the purpose of screwing it to a sliding piece, Z*a* is then capable of sliding in an inlet groove, OP, supported by hinges at S and T; whence, taking hold of the arm at V, and sliding it toward or from P, Z*a* will have an horizontal movement, by which the telescope and trough, AB, will be elevated or depressed, and with a beautiful slow movement.

As for the horizontal range, or for turning the whole to any azimuth, the operation is so simple as to require no explanation.

The telescope thus supported, and the pedestal resting on sand, I have found by experience that nothing will disturb it but the wind.

NOTE.—To all telescopes of great power it is better to have two finders, the one of a great field of view.

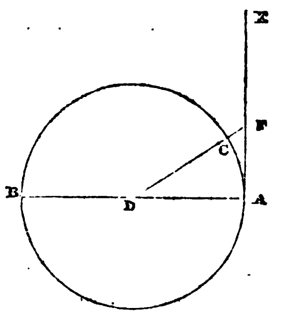
MATHEMATICAL CASE.

SIR,—In page 374 I find the question—" Can a straight line touch the circumference of a circle in any point at a less angle than 90°, with the radius drawn from that point to the centre?" I am inclined to doubt the correctness of the conclusion drawn by your plural Correspondents, " Discipuli." It appears feasible at the first " dip;" but I think, if the " bucket" be allowed to sink a little deeper, a different conclusion will be drawn.

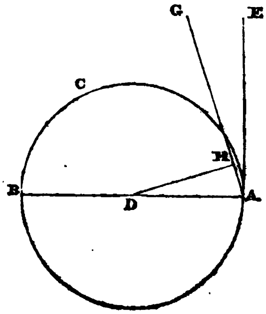
After a careful investigation of those particular propositions of Euclid which bear upon the point in question, I see no reason to doubt the correctness of the conclusions which Euclid has drawn, and which are the reverse of the one drawn by the " Discipuli." As some of your readers may not have Euclid to refer to, I will quote his 16th Proposition, Book III., which bears directly on this point.

" *The straight line drawn at right angles to the diameter of a circle from the extremity of it falls without the circle; and no straight line can be drawn between that straight line and the circumference, from the extremity of the diameter, so as not to cut the circle.*

" Let ABC be a circle, the centre of which is D, and the diameter AB; and let AE be drawn from A perpendicular to AB, and AE shall fall without the circle.



" In AE take any point, F; join DF, and let DF meet the circle in C. Because DAF is a right angle, it is greater than the angle AFD (Prop 32, Book I.); but the greater angle of any triangle is subtended by the greater side (Prop. 19, Book I.), therefore DF is greater than DA; now DA is equal to DC, therefore DF is greater than DC, and the point F is therefore without the circle. And F is any point whatever in the line AE, therefore AE falls without the circle.



" Again, between the straight line, AE, and the circumference, no straight line can be drawn from the point A which does not cut the circle. Let AG be drawn in the angle DAE; from D draw DH at right angles to AG; and because the angle DHA is a right angle, and the angle DAH less than a right angle, the side DH of the triangle DAH is less than the side DA. (Prop. 19, Book I.) The point H is therefore within the circle, and therefore the straight line AG cuts the circle.

" COR.—Hence it is manifest, that the straight line which is drawn at right angles to the diameter of a circle from the extremity of it touches the circle, and that it touches it only in one point; because, if it did meet the circle in two, it would fall within it. (Prop. 2, Book III.) Also it is evident that there can be but one straight line which touches the circle in the same point."—*Playfair's Geometry.*

This conclusion appears to me decisive. Suppose the line AG at the smallest imaginable distance from AE, still a line drawn from D, meeting AG at right angles, will form a

right-angled triangle, DAH, of which DA (the hypothenuse) will be the greater side; and, therefore, DH is less than DA, and within the circumference; and (by Prop. 2, Book III.) AE cuts the circumference in *two* places.

Your Correspondent (or *dents*) will not need to be reminded, that a mathematical point or line is not such as to be seen by the naked eye, nor even by the best microscopes. The points and lines in a diagram are seen, but they are merely a guide to the inward or mental view. In such questions as the above, we must first draw lines at *perceptible* distances; and if we want to draw conclusions from imperceptible distances, we must carry on the operation mentally, from the facts deduced at perceptible distances.

I am, Sir,
Yours respectfully,
R. H.

[We have also received answers *ad Discipulos* from Amicus, Acute Angle, Napier, B., J. P. G., F. O. M., and Zero, one or more of which we shall (probably) give in our next.—EDIT.]

SECRETS IN SELLING.

SIR,--I am afraid C. M. will still find himself a little in the mist, notwithstanding the ingenious solution given by F. O. M., page 381, for how he is to find the value of 0 from the two heights of the barometer? I shall propose the following question to be solved from F. O. M.'s formula:—Suppose a cubic foot of cork exactly balances 241 ounces avoirdupois of lead, when the barometer stands at 28°, what will be the weight of the same piece of cork when the barometer stands at 31°, the temperature of the air in both cases being 55°?

I am, Sir,
Yours respectfully,
G— S—.

P.S. Mr. F. O. M. does not show what correction should be made on account of difference of temperature.

SIR H. DAVY'S COPPER SHEATHING.

The following paragraph from the *Plymouth Journal* has, during the past month, gone the round of all the newspapers:—

"*Failure of Sir* H. DAVY'S *Plan for the Protection of Ships' Bottoms.*

"The plan some time since recommended by Sir H. Davy, to prevent the *oxidation* of copper on ships' bottoms, and which was adopted by Government, with a laudable zeal for the interest of *science*, has not been found to produce the expected benefits. In the instance of one of his Majesty's ships, which was fitted four years ago upon Sir H. Davy's plan, and which is now undergoing repair in this dock-yard, it appears that the galvanic influence of the iron has indeed prevented the oxidation of the copper, but the bottom of the ship is found, as in the case of wood-sheathing, to be foul with weeds and *barnacles*, to provide against which, copper bottoms were originally adopted. We understand that orders have been received to discontinue the fitting of his Majesty's ships upon Sir Humphry Davy's principle."

We deferred copying this (apparently exaggerated) statement into our publication, until we should see what answer or explanation it would draw forth from the learned President of the Royal Society, or his friends. In the Annals of Philosophy for the present month (October), Mr. Children has given the explanation for which we waited. It appears from this, that Government have *not* abandoned Sir H. Davy's plan *altogether*; that the application of his protectors is merely suspended for *sea-going* ships; and that it is ordered to be applied to all ships in good condition in ordinary (the Royal Sovereign, for instance), as also to stationary ships, such as sheer-hulks, receiving-ships, &c.—Mr. Children adds the following remarks, in the spirit of which we fully concur:—

"It is not for us to question the propriety of the measures adopted by the Lords Commissioners of the Admiralty, though we cannot help

still thinking, that by a due adjustment of the proportion of the *protecting* to that of the *copper* surface, the mode may yet be found perfectly applicable to *sea-going ships*, as well as those in ordinary. It seems to us to be one of those cases in which the *theory* is so obviously correct, that whatever difficulties may occur in the earlier attempts to reduce the method to practice, there must be certain circumstances which, when once discovered, will ensure complete success. What those circumstances are, can only be determined by reflection and experiment. Sir Humphry Davy has already done much; and we do hope that every facility will be offered him for continuing and perfecting his labours on this nationally momentous subject. He has victoriously contended with difficulties far greater, in our estimation, than any that await him in this investigation, and we confidently predict that his keen and indefatigable genius will ultimately triumph over every present obstacle."

SOUTH'S COLLIMATION ADJUSTMENT.

SIR,—As Mr. South's Method of finding the Error of Collimation does not, as far as I can recollect, differ much from that which is commonly used, I take the liberty of endeavouring to answer Mr. F. Ford's objection, but shall feel obliged to any one who would correct me if I am in error.

The line of collimation is the line joining the principal focus of the object-glass with the centre of the eye-glass, and in this line the middle wire of the telescope should be placed, and any error in adjustment will cause a corresponding error in time. Now, if the time of crossing the first and second wires be observed, and the instrument be moved through 180 deg. azimuth, and the telescope be made to revolve back through an arc equal to twice the zenith distance of the star, it will be again directed to the star, and whatever error took place before in one direction now takes place in the opposite direction—thus the two errors compensate each other; and by dividing the time between the stars appearing on the 1st and 5th, and on the 2nd and 4th wires, we get the error of collimation—this is, "*si rite audita recordor*," the principle of Mr. South's method. What Mr. F. Ford does not understand is, how the telescope can be instantaneously reversed. My answer to this is, that it is not done instantaneously, nor is it necessary that it should: the instrument, in order to perform this operation, must have an azimuth as well as a vertical motion, and the time in which the star passes from one wire to the next (which time, it is possible, may be increased by the error of collimation itself, the telescope being reversed), is, I take it, sufficient for this operation. Your Correspondent will ask how a mural circle, which has no azimuth motion, can be corrected for collimation? the answer, I believe, will be, that in this case a zenith sector will be necessary, having motion in azimuth (as I believe they all have) to find the error of collimation in the circle; for if an observation be taken in the same observatory, at the same time, on the same star, the only difference which can arise is from the collimation, refraction and all other corrections applying equally to both. Sometimes, when the error of the clock is accurately found from other observations, the mural circle is itself moved. For any more explanation on this subject, I beg to refer Mr. F. F. to Mr. Woodhouse's Astronomy, vol. I. part I., chap. 5.

I remain, Sir,

Yours most respectfully,

F. O. M.

Nottingham, September 25th.

PERPETUAL MOTION.

SIR,—A few years since, having read a Treatise on Mechanical Powers, by Bishop Wilkins (having never before thought for a moment on such a subject), I was, as it were, struck dumb with admiration and astonishment. My mind being thus highly

excited, no wonder that I soon felt desperately enamoured of that "chaste wanton," the Perpetual Motion. But, to tell the truth, this same chaste lady teazed me sadly for some time with many a wanton and vexatious trick; often, as I just thought I had her firm and fast, the mask fell, and, behold, 'twas but a phantom. However, like a true lover, I still pursued, and am now happy to say that my endeavours are crowned with perfect success. By dint of assiduous perseverance I have, at last, overcome every scruple of this heretofore very coy lady, and now possess her in her most charming simplicity.

Now, Mr. Editor, if you have any curiosity to know "what she is like," please read the following:—To speak in plain terms, this perpetual motion is produced by means of a cistern of water, syphon, and water-wheel.

Respecting the particular construction of the wheel, or the exact shape of the syphon's mouth, I need not at present be too minute. Suffice it to say that the wheel is undershot, and in revolving completely removes the pressure of the air from the mouth of the syphon, which otherwise could not work, it being the shortest leg. The water discharged on the wheel returns again to supply the cistern, and so on perpetually, in one eternal round.

Any gentleman or lady, that pleases, may have a small one made of gold, or any other metal they like best, with quicksilver fluid, to stand in a glass case on the parlour-table.

I would have published this discovery long before this time, were it not that I was endeavouring to have a handsome one fitted up, with a novel specimen of clock-work erected thereon, and which I intended to have presented before the Society of Arts.

It is, Sir, purely owing to accident that I presume to intrude at all on your notice. A few days since, having heard of the fame of your truly valuable Magazine, I purchased it, and really found it a most delicious feast; but was not a little alarmed at finding that one of your ingenious Correspondents had very nearly pounced upon my favourite hobby-horse—I mean the gentleman who made the short leg of the syphon discharge water by blowing over the mouth of it with a bellows. Had he gone a single step farther, and clapt up the wheel instead of the bellows, farewell to the long-cherished hope of having my name handed down to posterity as the inventor of the first real perpetual motion. Therefore, Sir, to prevent such a sad mischance, if this subject is not now grown too unfashionable for your pages, I shall feel highly obliged by allowing it a corner.

I am, Sir,

Your most obedient servant,

G. V. G.

[We must disclaim having given any sanction to the *display* with which this ingenious article has been honoured. On making inquiry of the Printer's Devil, as to the reason of it, he asked, simply enough, "If it was not true, then, that this was the grand perpetual motion discovered at last?"—Ed.

Sir,—Having, more than twelve months since, attempted a continued or perpetual motion, precisely on the same plan as that suggested by Mr. T. Bell, in the 109th Number of the Mechanics' Magazine, I think it but fair to mention the circumstance, and at the same time give my reasons why I do not think it would succeed.—The experiment I made was with a number of corks, strung at intervals for the purpose, and passed through an aperture in the bottom of a glass vessel, to which they were fitted. As might be expected, the weight of the column of water over the aperture was superior to the buoyancy of the corks, and upon their being pressed upwards they were forced back again to the aperture. This to me was sufficient;

for the expansion of these corks in the manner described by Mr. Bell would, it appeared to me, not in the least increase their buoyancy, unless their bulk could also be increased at the same time.

As to the last plan alluded to by the same gentleman, it seems probable to me that a diagram I made some time since may not be dissimilar to it; but I will not attempt to anticipate his method. Should mine appear to possess an advantage over his, I will, with pleasure, send it for insertion (that having been my original intention), together with another method I have since thought of, and which is chiefly constructed on a well-known principle of hydrostatics.

I remain, Sir,
Your very obedient servant,
G + R.

Sir,—That the little device on the subject of Perpetual Motion, which you did me the favour to insert in your 106th Number, should have been deemed by your Correspondent, under the name of T. Bell, as entitling me to be considered "a young man of very promising abilities," must certainly be matter of great self-gratulation to me, and ought to be properly appreciated accordingly; and as he stretches out his fatherly hand, and smooths down the hair upon my forehead, it is only becoming me to hold down my head, and to find my youthful face appropriately suffused with the mingled blush of modesty and pride. But, Sir, old birds are not to be caught with *chaff;* and when next your Correspondent honours me with his encomiums, I hope he will, for the sake of my "self-complacency" and his own appearance of candour, make the motive (which is so obvious in this instance) a little less apparent; for, Sir, no sooner has he finished the above eulogium, than he, the said T. Bell, "*is forcibly struck* (the terms in which he announces to us the design to be his own invention) that there is a *better plan* of applying this principle than the one described by Philo Montis." He then gives you a description of "an endless chain, a pulley, cocks, springs, and a hole in the bottom of a box;" by which apparatus, when put together, my poor, little, simple device is to be completely superseded, and taken entirely off its legs (one of which, to be sure, is rather dropsical, and the other not a little crooked). Thus, "as if by magic," deprived of my *laurels*, and with my poor device in my hand, am I to be hurled, "at one fell swoop," from "the battlements of the superstructure" on which I "had planted my fondest hopes," and of the unfortunate Montis there is to be left not even so much as "a wreck behind;" whilst the bell upon the battlements—"the mighty Tom"—"who sounds so woundy great," rings, in derision, the knell of all my hopes to immortality.

But, Sir, to the object for which I take the liberty of addressing you.—Really I am not disposed to concede to Mr. Bell (who is as unknown to me as I am to him) *even* the merit of having devised the best of two plans, *both of which are good for nothing*. In the first place, the design I have given could be made to act for a time; the machine of the "better plan," I, with equal confidence, assert would never stir of itself at all. If this is true (and which, I dare say, your well-informed Correspondent will have the fairness to acknowledge he believes would be the fact), the "better" must be considered the worst plan of the two. The defect in mine, I think it will be allowed, is a little observed; but the amazing resistance from friction necessary to draw a sort of contitinued piston through the hole in the bottom of the box, joined to the pressure of the superincumbent and surrounding water, as well as the friction of the pulley, never leave us for a moment able to suppose such a contrivance could act at all. I have thought of the same thing as that described by Mr. Bell before I read his account, but I should have never thought of mentioning to any one a conception, in my humble opinion, and, which it "strikes me very forcibly" to be, completely preposterous. As I have not intended really to offend in any way your well-informed Correspondent, I hope to hear from him that I have not accidentally done so, although I must still contend that my little device is as good, at least, as his great one.

I am, Sir,
Your obedient servant,
Philo Montis.
September 27th, 1825.

DIVING FISHERMEN.

There is a mode of catching fish peculiar to the Gulf of Petrassó. The fisherman being provided with

a rope, made of a species of long grass, and which floats near the surface, has only to move his canoe where he perceives there is a rocky bottom; this done, he throws the rope out, so as to form a tolerably large circle; and such is the timid nature of the fish, that, instead of rushing out, it never attempts to pass this imaginary barrier, which acts as a talisman, but instantly descends, and endeavours to conceal itself under the rocks. Having waited a few moments till the charm has taken effect, the fisherman plunges downwards, and not unfrequently returns with four or five fish, weighing from two to six pounds each. As they seldom find more than the heads concealed, there is the less difficulty in bringing forth their rich prizes; and when the harvest is good, the divers are so dexterous, that they have a method of securing three or four fish under each arm, beside what they can take in their hands. The fish greatly resembles the John Dory.

REFRIGERATING SALT.

If we mix 57 parts of muriate of potash with 32 of muriate of ammonia, and 10 of nitrate of potash, a refrigerating salt will be produced. This salt, put into four parts of water, and quickly agitated, will make the thermometer descend from 20° to 5° below zero in Reaumur's thermometer.

COLD PRODUCED BY THE COMBINATION OF METALS.

According to M. Dobereiner, the fusible metal consists of one atom of lead, one of tin, and two of bismuth; and it becomes fluid when exposed to a heat of 210°. If the fusible metal, formed of 118 grains of filings of tin, 207 grains of filings of lead, and 286 grains of pulverised bismuth, be incorporated in a dish of calendered paper, with 1616 grains of mercury, the *temperature will instantly sink* from 65° to 14°. M. Dobereiner thinks that it might sink so low as the freezing point of mercury, if the experiments were made at a temperature a little under 32°.

POWER REQUIRED FOR DIFFERENT VELOCITIES OF STEAM-BOATS.

We extract the following Table from a valuable paper on Steam-boats, by Mr. Tredgold, in the last Number of Professor Jamieson's Edinburgh Philosophical Journal. The immense increase of power which appears to be necessary to obtain a small increase of velocity is very remarkable, and must have a great influence in inducing a preference of engines of a moderate size. The calculation applies to still water.

Miles per hour.	Horses' power.
3	5½
4	13
5	25
6	43
7	69
8	102
9	146
10	200

INSTRUCTION FOR MECHANICS AT PARIS.

The celebrated Baron Charles Dupin, of the Institute, has undertaken to give instructions to the industrious classes in geometry and in mechanics, as applied to the arts. His instruction extends to the great manufactures, as well as to the most ordinary and common arts of life, and even to the fine arts. The architect, the carpenter, the mason, the sculptor, the painter, and the engraver, each require a knowledge of certain geometrical or mechanical principles: M. Dupin supplies them with this knowledge. The knowledge he teaches is necessary to all mechanics, and artists who have any thing to do with mechanics. In some cities of France some learned Professors have hastened to follow M. Dupin's example, and others propose to follow it.—*French Paper.*

METHOD OF PREVENTING OIL AND GAS LAMP GLASSES FROM BURSTING.

The glass chimneys which are now in such general use, not only for oil lamps, but also for the burners of oil and coal gas, very frequently burst, owing sometimes to knots in the glass, when it is imperfectly annealed, but more frequently to an inequality of thickness at the lower end, which prevents the glass from expanding uniformly when heated. M. Cadet de Vaux informs us that, when the evil arises from the latter cause, it may be cured by making a cut with a diamond in the bottom of the tube. He states, that in an establishment where six lamps are lighted every day, and where this precaution was taken, there was not a single glass broken for nine years.

ANSWERS TO INQUIRIES.

NO. 147.—COLOURING BRICKS.

SIR,—I send you the following receipt for colouring Tiles:—

Take one ounce of red lead to three ounces of manganese; get some strong clay, mix it with clean water until it is as thick as cream; pass it through a very fine sieve, then mix it with the lead and manganese. Let your tiles be dry; then pour it over them, and set them to dry. Do not let them touch each other in the setting, and keep them free from dust as much as possible in the kiln. I have only made one trial of this method, but it answered very well. To make your bricks and tiles of one colour, mix all the different sorts of clay well together.

I am, Sir,
Yours respectfully,
FRANK BUTTON,
Colston, Brickmaker.
Near Nottingham.

NO. 137.—VIOLIN VARNISH.

Take half a gallon of rectified spirits of wine, to which put six ounces of gum mastic, and half a pint of turpentine varnish (which may be got for less expense at the colour-shops than it can be made for, except in large quantities); put the above in a tin can, keep it in a very warm place, frequently shaking it, until dissolved; strain it, and keep it for use. Should you find it harder than you wish, you may add a little more turpentine varnish.

HENRY HOPE.

NOTICES TO CORRESPONDENTS.

"A Real Friend," and "the circle" of friends he represents, seem to misunderstand entirely the principle on which our publication is conducted. Were we to admit nothing but what is "*unquestionably* correct and good," the Mechanics' Magazine would be converted into a mere repository of well-known doctrines and precepts, instead of continuing, as it has heretofore done with so much approbation, to be the vehicle of every thing in the shape of original and ingenious speculation.

Communications received from—Experimentum—Crucis—A Mechanic—M. Welch—J. C. E.—W. S.—W. B.—Mr. Thomas—F. J—k—n—Jack Long—T. S.—A. B.—J. O.—W. C.—B. P. C.—Samoht—G. S.

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NEW PATENT STEAM-COACH,

INVENTED BY MESSRS. TIMOTHY BURSTALL AND JOHN HILL, ENGINEERS.

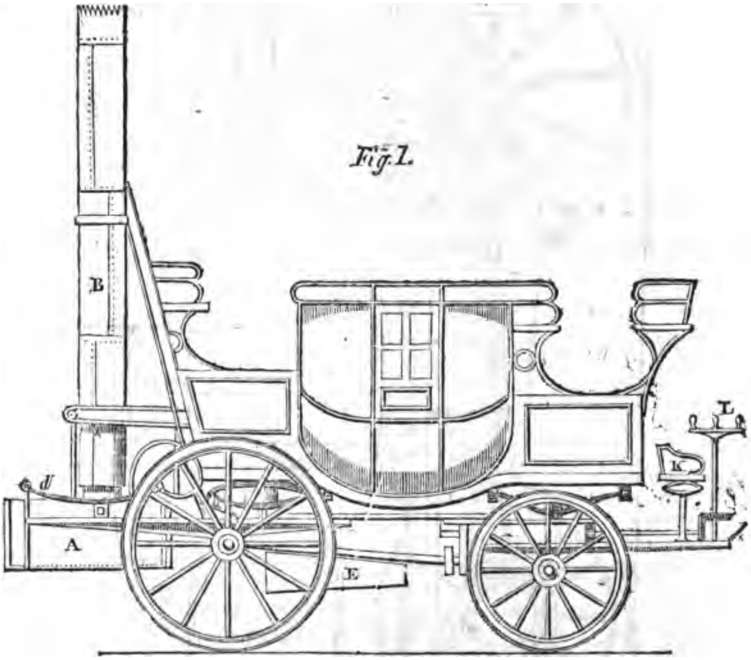

Fig. 1.

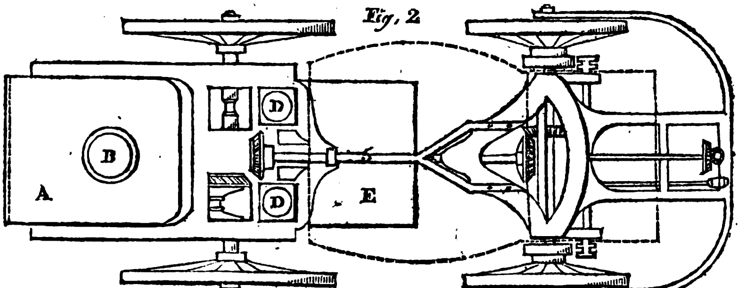

Fig. 2

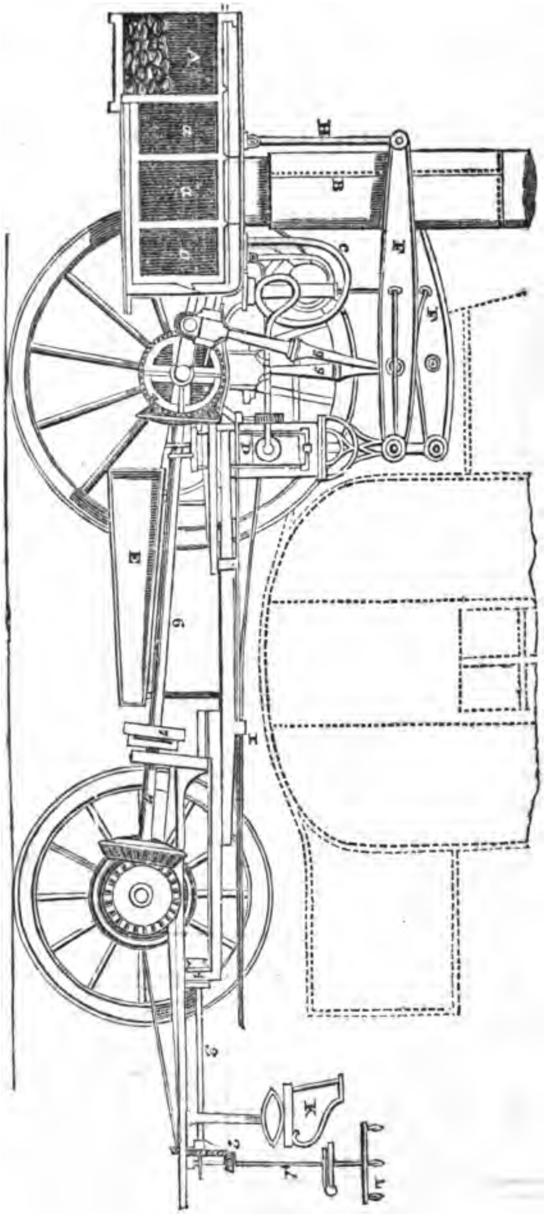

Fig. 3.

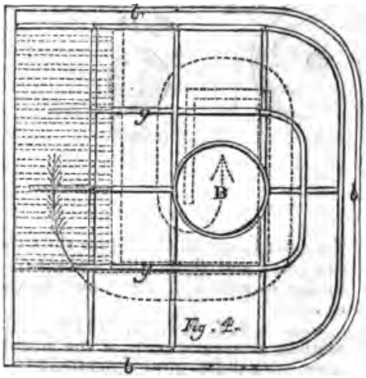

Fig. 4.

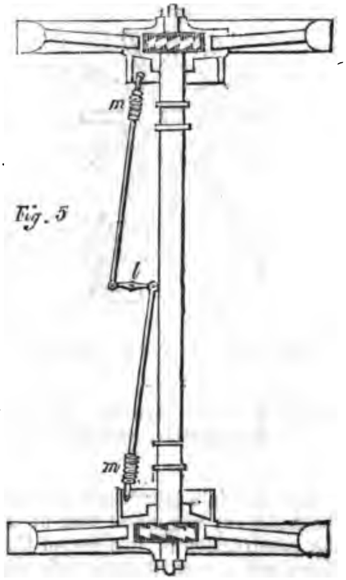

Fig. 5

Fig. 6.

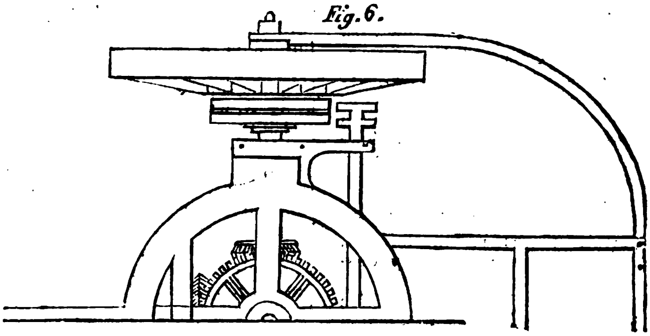

Fig. 7

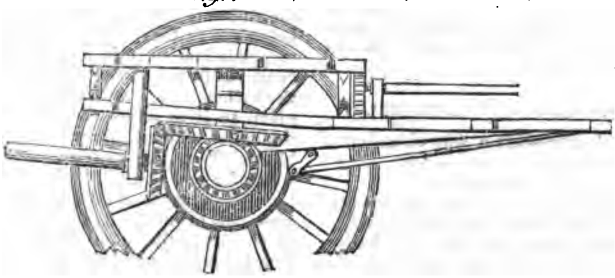

Fig. 8

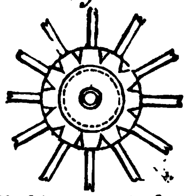

Fig. 11

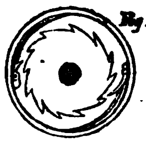

Fig. 12

Fig. 10

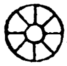

Fig. 9

NEW PATENT STEAM COACH.

Invented by Messrs. TIMOTHY BURSTALL and JOHN HILL, Engineers.

We gave in a late Number (from the *Scotsman*) a general idea of the the construction of this Steam Carriage, and now extract the following more particular description of it from the Edinburgh Philosophical Journal:—

This invention of a locomotive steam-carriage consists in the combination and employment of principles, some of which are new in their application to this purpose, and others well known and in general use. The leading features of the invention may be comprehended under the following heads:—

1st. The arrangement of machinery, and certain pieces of mechanism, adapted to effect the necessary evolutions of a locomotive carriage.

2ndly. The novel construction of a boiler or generator for the production of steam, and the peculiar kind of pipe or curved passage for conducting the steam to the engine; and,

3rdly. The mode of supplying the boiler with water, by means of pneumatic pressure, as exhibited in the plans and sections.

Description of the Drawings.

Fig. 1 represents a side elevation of the coach, with the body, &c.

Fig. 2 is a ground plan.

Fig. 3, a section, on an enlarged scale, of the boiler and machinery.

Fig. 4 exhibits the top of the boiler, with the feed-pipe, and receptacles for water, as will be afterwards explained: the dotted lines in this figure show the fire-place and flues, the arrow being in the direction of the flame to the chimney.

Figs. 5, 6, 7, 8, 9, 10, are plans and sections of several parts of the machinery, with different modifications.

Fig. 11, a plan of the ratchet-box, and part of the nave.

Fig. 12 is a top view of a plate fixed on the spindle of the steering-wheel, to indicate to the conductor the angle of obliquity of the two axles. The same letters and figures refer to the same parts in all the plans.

A represents the boiler, which is formed of a stout cast-iron or other suitable metal flue, inclosed in a wrought iron or copper case, as seen in section at fig. 3, where A is the place for fuel, and *a, a, a,* are parts of the flue, as seen in section; the top being formed, as at fig. 4, into a number of shallow trays or receptacles for containing a small quantity of water in a state of being converted into steam, which is admitted from the reservoir by the small pipe, *g, g;* while *b, b, b,* is the outer wrought metal case for containing the steam for the use of the engine. B is the chimney, arising from the centre flue. D, D, are the two cylinders, which are fitted up with pistons and valves, or corks, in the usual way, for the alternate action of steam above and below the pistons. The boiler being suspended on springs, *d,* the steam is conveyed from it to the engines through the helical pipe, *e,* which has that form given to it to allow the vibration of the boiler without injury to the steam-joints. F is the cistern, containing water for one stage, say 50 to 80 gallons, and is made of strong copper, and air-tight, to sustain a pressure of about 60 pounds to the square inch. By *e* is denoted one or more air-pumps, which are worked by the beams of the engines,

and are used to force air into the water-vessel, that its pressure may drive out, by a convenient pipe, the water into the boiler, at such times and in such quantities as may be wanted. F, F, are two beams, connected at one end with the piston-rods, and at the other with the rocking standards, H, H. At about one-fourth of the length of the beams from the piston-rods, are two connecting-rods, *g*, *g*, their lower ends being attached to two cranks, formed at angles of 90 degrees from each other on the hind axle, giving, by the action of the steam, a continued rotatory motion to the wheels, without the necessity of a fly-wheel. The four coach-wheels are attached to the axles nearly as in common coaches, except that there is a ratchet-wheel formed upon the back part of the nave, with a box wedged into the axle, containing a dog or pall, with a spring on the back of it, for the purpose of causing the wheels to be impelled when the axle revolves, and at the same time allowing the outer wheel, when the carriage describes a curve, to travel faster than the inner one, and still be ready to receive the impulse of the engine as soon as it comes to a straight course.—The box and pall are shown separate, at 11.

Figs. 5, 8, 9, and 10, show a different method of performing the same operation, with the further advantage of backing the coach when the engines are backed. In this plan the naves are cast with a recess in the middle, in which is a double bevil clutch, the inside of the nave being formed to correspond. These clutches are simultaneously acted upon by the rods and small lever, *b*, with the helical springs, *m m*, and which, according as they are forced to the right or left, will enable the carriage to be moved forward or backward. To the fore naves are fixed two cylindrical metal rings, round which are two friction-bands, to be tightened by a lever convenient for the foot of the conductor, and which will readily retard or stop the coach when descending hills. K is the seat of the conductor, with the steering-wheel, L, in front, which is fast on the small upright shaft, 1, and turns the two bevil pinions, 2; and the shaft, 3, with its small pinion, 4, which, working into a rack on the segment of a circle on the fore carriage, give full power to place the two axles at any angle necessary for causing the carriage to turn on the road, the centre of motion being the perch-pin, *1.

The fore and hind carriage are connected together by the perch, 5, which is bolted fast at one end by the fork, as seen at fig. 2, and at the other end is secured by two collars, which permit the fore and hind wheels to adapt themselves to the twist of the road.

To ascend steep parts of the road, and particularly when the carriage is used on railways, or to drag another behind it, greater friction will be required on the road than the two hind wheels will give, and there is therefore a contrivance to turn all the four wheels. This is done by the pair of mitre-wheels, 4, one being on the hind axle, and the other on the longitudinal shaft, 6, on which shaft is a universal joint directly under the perch-pin, *1, at 7. This enables the small shaft, 7, to be turned, though the carriage should be on the lock. On one end of the shaft, 7, is one of a pair of bevil-wheels, the other being on the fore-axle, which wheels are in the same proportion to one another as the fore and hind wheels of the carriage are, and this causes their circumference to move on the ground at the same speed.

Fig. 6 is a ground plan, and fig. 7 a section of another way of impelling all the wheels together, where the perch-pin is over the centre of the axle. 8 is a wheel turning upon it, which, being put in motion by the wheel 9, will cause it, by means of the wheel 10, to turn the fore-axle, and thereby the wheels.

There are safety-valves and cocks to admit, shut off, and regulate the steam, &c. But as the engraving is necessarily on a small scale, and such things are familiar to mechanicians, we have thought it unnecessary to cumber our account with them.

It only remains for us to say, that the object of the patentees is, in the peculiar construction of a boiler, to make it a store of caloric; they proposing to heat it from 250 to 600 or 800 degrees of Fahrenheit; and by keeping the water in a separate vessel, and only applying it to the boiler when steam is wanted, they accomplish that great desideratum in the application of steam to common roads, of making just such a quantity of steam as is wanted; so that, when going down hill, where the gravitating force will be enough to impel the carriage, all the steam and heat may be saved, to be accumulating and given out again at the first hill or bad piece of road, when, more being wanted, more will be expended.

The engines are what are called high-pressure, and capable of working to 10-horse power, and the steam is purposed to be let off into an intermediate vessel, that the sound emitted may be regulated by one or more cocks.

From the Repertory of Patent Inventions.

The patentees seem to have taken great pains to render this steam-carriage as perfect as the knowledge as yet acquired, relative to this mode of conveyance, would permit; and the evident improvement which it exhibits on some of its predecessors, gives great hopes that the desirable object of making steam-carriages capable of moving effectually on common roads, will be attained at no distant period.

The great impediment to the application of steam-carriages to common roads, is their enormous weight, which, in few cases yet made public, has been much less than eight tons; to which, if the usual load of goods put on an eight-horse waggon were added (to supply the place of stage-waggons being one of the objects of the patentees), no common road yet made could support them. It would therefore be an object well worth that ingenuity which the patentees have shown in the construction of their steam-carriage, to contrive means for lessening the weight of those vehicles in every possible way, as well as to pursue the plan already used on railways, of having carriages for conveying the mercantile goods, or the passengers, quite distinct from that of the steam-engine, which, for the latter purpose, would also be desirable for other obvious reasons; for, exclusive of the idea of danger, which sitting close to a caldron of boiling water, subject to be precipitated on them by an unlucky stone or rut in the road, might give to people, otherwise not very timorous, the great heat of the furnace and boiler would be very objectionable, at least during the warm months. In this way the steam-carriages would serve the purpose of horses to draw other carriages (which they so far resemble, that on the rail-roads where they are used they are called, we are informed, *iron horses*, by the workmen); and for common roads this separation of the weight on separate carriages would be even much more necessary than for rail-roads, on account of their being formed of materials so much less hard and durable. Among the methods proposed for making engines more light, that of using boilers constructed of small pipes seems very worthy of attention, several modes of which have been already made public; among the more recent of which, that for which Mr. Theodore Paul has lately obtained a patent, seems in some respects to deserve a preference; but requiring, in order to complete it, the addition of Mr. Perkins's patent principle, of confining the heated water in the pipes by a weighted valve, till the instant of its being let off to act on the piston of the engine in the form of steam; as the water without this would be blown totally out of the pipes by the steam formed in its lower extremities.

The method of forcing the water into the boiler by the pressure of air, in an engine where no condensation is required, which is the case in that of the patentees, can do no injury to the general effect, and may be of some service on the principle applied in M. Latour's air-engine (for which see Nicholson's Phil. Journal, vol. xxix., p. 175), who caused a wheel to revolve by the expansion which the air received in passing from cold water into that heated to the boiling point; and as some of the air pressed into the patentees' water reservoir will be absorbed by the water, and pass over with it into the boiler, it will so far have a similar effect. It is also probable that the air-pumps will keep longer and better in order than small water forcing-pumps, both from air having less action on metal, and not being so liable to carry along with it extraneous substances.

MANUFACTURE OF RED CRAYONS.

The Red Crayon, and its use, are too well known in daily life to require any thing to be said of them. The preparation of the red crayon,

which is best adapted for painting, is less known. The following is the manner in which it is performed :—A quantity of hematite is pounded in a porphyry mortar, with filtered water, until it be extremely divided, so as to form an impalpable powder. This powder is again diffused through a quantity of water sufficient to allow the mixture to pass through a fine sieve, placed above a large vessel filled with water. The liquid holding the hematite in suspension is then agitated, and, after this, allowed to rest four-and-twenty hours. At the end of this time there is formed at the bottom of the vessel a deposit of hematite, in the form of a very fine powder: the water is cautiously decanted from it. To form crayons of this impalpable powder, a uniting substance is necessary. This is afforded by gum arabic or isinglass, of which the proportions vary according to the use to which the crayon is destined, less of it being required for soft crayons, which consequently leave their colouring matter more readily, and more for the hard ones, which preserve their point longer. The following are the proportions, deduced from experiment, to be employed in the five kinds of crayons, which we shall enumerate. 1. For the red crayons, with large marks, 18 grains of dry gum arabic to one ounce of prepared hematite powder. 2. For the hard-grained crayons, 21 grains of gum to one ounce of hematite powder. 3. For the crayons, with small and fine marks, 27 grains of gum to one ounce of hematite. 4. For the crayons, with less fine marks than the preceding, 22 grains of gum. 5. For the crayons, with shining marks, 36 grains of ichthyocolla to one of prepared hematite powder.—The gum or isinglass is dissolved in a sufficient quantity of water; the solution is passed through a linen cloth; the powder is then added; the liquid is brought near a gentle fire, until the mass is somewhat thickened; it is then removed from the fire. The mixture is very carefully bruised upon the porphyry, to render it as intimate as possible; and it is then formed into crayons. The mass, when it has acquired the proper consistence, is made to pass through a cylinder; the sticks thus formed are dried, and divided into crayons of two inches long; they are sharpened, and the skin which has formed upon them, while drying, is removed.

THE SINGLE-WHEEL CLOCK.

SIR,—Having sent to your valuable journal for the promulgation of mechanical science, an account of a very simple Clock, or rather Timepiece, in my possession, consisting of only one wheel, and which you were pleased to publish in vol. III. page 319, I have since observed in your Miscellany, No. 106, page 341, vol. IV. that one of my brother subscribers, dated Royston, states that he has made a clock agreeably to my given plan and principle, but that he is much disappointed to find it did not answer, as, when the barrel was wound up, it unwound itself in two minutes, and could not, by any weight, be prevented from thus rapidly descending. I have, in consequence thereof, more minutely examined the clock (which I have by me), and I find little difference in the dimensions which he has given of the proportionate lengths and diameters of the works, except that the wheel diameter may be called five inches; but this difference I do not look upon as material. Being determined, however, to ascertain the reason of the failure, I have accordingly dissected the barrel containing the liquid which unwinds the catgut off the spindle, or rather arbor, and I find the tin barrel is divided into five cells, having five tin partitions soldered in at equal distances, which cells or divisions are continued to within 1-8th of an inch of the arbor or spindles, so that they are all open to each other, and the water can pass out of one cell to the other, running out at the small opening next the arbor. I also observe there is a small hole, not larger than the smallest shot-hole, in the centre of each tin division within a quarter of an inch of the outer rim; this I conclude is for an air vent. These divi-

sions, by letting the water flow only gradually, constitute, I imagine, the grand secret of its being enabled to keep time, the same being checked again by the hook and line passing round the grooved wheel, and balanced by shot. I have also to observe that I found the barrel, when opened, to contain about half a pint of fetid water, strongly impregnated with verdigris from the materials of the barrel. The water is put in after the barrel and divisions are all nicely soldered, by a small hole in the side near the entrance of the arbor, the hole being afterwards soldered up.

I am, Sir,
Your obliged servant,
B— P— C—.

Thirza-place, Kent-road.

ON THE EMPLOYMENT AND WORKING OF ANIMAL HORN IN GENERAL.

BY M. VALLET.

[*Translated from the French.*]

Horn, particularly of oxen, cows, goats, and sheep, is a substance soft, tough, semitransparent, and susceptible of being cut and pressed into a variety of forms; it is this property that distinguishes it from bone. Turtle or tortoise shell seems to be of a nature similar to horn, but, instead of an uniform colour, it is variegated with spots. These valuable properties being known, renders horn susceptible of being employed in a variety of works fit for the turner, comb and snuff-box maker. The means of softening the horn need not be described, as it is well known to be by warmth; but an account of the cutting, polishing, and soldering it, so as to make plates of large dimensions, suitable to form a variety of articles, may be desirable. The kind of horn most to be preferred is that of goats and sheep, from its being whiter and more transparent than the horn of any other animals. When horn is wanted in sheets or plates, it must be steeped in water, to be able to separate the pith from the kernel, for about fifteen days in summer, and a month in winter; and when it is soaked, it must be taken out by one end, and well shook and rubbed, in order to get off the pith, after which it must be put for half an hour into boiling water, and then taken out and the surface sawed even lengthways; it must again be put into the boiling water to soften it, so as to render it capable of separating, then, with the help of a small iron chisel, it can be divided into sheets or leaves. The thick pieces will form three leaves; those which are thin will form only two, whilst young horn, which is only one quarter of an inch thick, will form only one. These plates or leaves must again be put into the boiling water, and when they are sufficiently soft, they must be well worked with a sharp cutting instrument, to render those parts that are thick, even and uniform; it must be put once more into the boiling water, and then carried to the press.

At the bottom of the press employed there must be a strong block, in which is formed a cavity of nine inches square, and of a proportionate depth; the sheets of horn are to be laid within this cavity in the following manner, at the bottom:—First a sheet of hot iron, upon this a sheet of horn, then again a sheet of hot iron, and so on, taking care to place at the top a plate of iron even with the last, and the press must then be screwed down tight.

There is a more expeditious process, at least in part, for reducing the horn into sheets, when it is wanted very even. After having sawed it with a very fine and sharp saw, the pieces must be put into a copper used for the purpose, and there boiled until sufficiently soft, so as to be able to be split with pincers: then bring quickly the sheets of horn to the press, where they are to be placed in a strong vice, the chaps of which are of iron and larger than the sheets of horn, and screw the vice as quick and tight as possible; let it then cool in the press or vice, or it is as well to plunge the whole into cold water. The last mode is preferable, because the horn does not dry up in cooling. Now draw out the leaves of horn, and introduce other horn to undergo the same process. The horn so enlarged in pressing is to be submitted to the action of the saw, which ought to be set in an iron frame, if the horn is wanted to be cut with advantage, in sheets of any desired thickness, which cannot be done without adopting this mode. The thin sheets thus produced must be kept constantly very warm, between plates

of hot iron, to preserve their softness. Every leaf must be loaded with a weight heavy enough to prevent its warping. To join the edges of these pieces of horn together, it is necessary to provide strong iron moulds suited to the shape of the article wanted, and to place the pieces in contact with copper-plates, or with polished metal surfaces against them; when this is done, the whole is to be put into a vice and screwed up tight, then plunged into boiling water, and after some time it is to be removed from thence and immersed in cold water, which will cause the edges of the horn to cement together, and become perfectly united.

To complete the polish of the horn, the surface must be rubbed with the subnitrate of bismuth by the palm of the hand. The process is short, and has this advantage, that it makes the horn dry promptly.

When it is wished to spot the horn in imitation of tortoise-shell, metallic solution must be employed, as follows. To spot it red, a solution of gold in aqua regia must be employed; to spot it black, a solution of silver in nitric acid must be used; and for brown, a hot solution of mercury in nitric acid. The right side of the horn must be impregnated with these solutions, and they will assume the colours intended. The brown spots can be produced on the horn by means of a paste made of red lead, with a solution of potash, which must be put in pieces on the horn, and subjected some time to the action of heat. The deepness of the brown shades depends upon the quantity of potash used in the paste, and the length of time the mixture lays on the horn. A decoction of Brazil wood, a solution of indigo, with sulphuric acid, a decoction of saffron, and Barbary tree wood, is sometimes used. After having employed these materials, the horn may be left for half a day in a strong solution of vinegar and alum.

In France, Holland, and Austria, the comb-makers and horn-turners use the clippings of horn, which are of a whitish yellow, and tortoise-shell skins, out of which they make snuff-boxes, powder-horns, and many curious and handsome things. They first soften the horn and shell in boiling water, so as to be able to submit them to the press in iron moulds, and by the means of heat form it into one mass. The degree of heat necessary to join, the horn clippings must be stronger than that for shell-skins, and which can only be attained by experience: the heat must not be too great, for fear of scorching the horn or shell. Considerable care is required in these operations not to touch the horn with the fingers, nor with any greasy body, because the grease will prevent its joining perfect. Wooden instruments should be used to move them while they are at the fire, and for carrying them to the moulds.

NEW METHOD OF BLEACHING SPONGE.

To bleach Sponge and render it perfectly white, it is necessary to soak it in cold water. But if it does not become soft, it must be immersed in boiling water; but this should, if possible, be avoided, for it has a bad effect on the sponge; particularly in cooling, it causes it to shrink and to become hard, and so tough as to prevent its being bleached; but if the sponge is soaked in cold water, and that water be changed three or four times every day, and every time the water is drawn off, the sponge should be pressed perfectly dry; this process being repeated for five or six days, it will, at the expiration of that time, be ready for bleaching.

If the sponge, as is frequently the case, should contain small pieces of chalk and shells, which cannot be got out without tearing it, the sponge must be soaked for twenty-four hours in muriatic acid, with twenty parts of water, which will cause an effervescence to take place, and carbonic acid gas to be liberated, when the shells and chalk will become perfectly dissolved; after that it must be carefully washed in fresh water, and immersed in sulphuric acid, the specific gravity of which must be 1,024 or 4 deg. on the hydrometer of Beaumé. The immersion of the sponge in this acid should continue for about eight days, but it must occasionally be pressed dry and thoroughly washed. After having been perfectly washed and cleaned, it should be sprinkled with rose water, to give it a pleasant smell, which completes the process.

RESULTS OF A METEOROLOGICAL JOURNAL, FOR SEPTEMBER, 1825.*

Kept at the Observatory of the Royal Academy, Gosport, Hants.

		Inches.			
Barometer	Highest	30.33,	September 28th	— Wind	S.E.
	Lowest	29.43,	14th		N.
Range of the Mercury		0.90.			

	Inches.
Mean Barometrical Pressure for the Month	29.895
——— for the Lunar period, ending the 12th inst.	30.003
——— for 15 days, with the Moon in North declination	29.924
——— for 14 days, with the Moon in South declination	30.082
Spaces described by the rising and falling of the Mercury	4.190
Greatest variation in 24 hours	0.360
Number of changes	21

Thermometer	Highest	78°,	September 2nd	— Wind	S.E.
	Lowest	47	5th		N.W.
Range		31			
Mean temperature of the external air		63.62			
——— for 31 days, with the Sun in Virgo		64.66			
Greatest variation in 24 hours		22.00			
Mean temperature of spring water at 8 A.M.		54.58			

DE LUC'S WHALEBONE HYGROMETER.

	Degrees.
Greatest humidity of the Air	95 in the evening of the 16th.
Greatest dryness of ditto	45 in the afternoon of the 6th.
Range of the Index	50
Mean at 2 o'clock P.M.	61.5
——— 8 o'clock A.M.	69.8
——— 8 o'clock P.M.	76.0
Mean of three observations each day, at 8, 2, and 8 o'clock	69.1

Evaporation for the Month .... 4.60 inches
Rain in the Pluviameter near the ground ... 2.430
Rain in ditto 23 feet high 2.210
Prevailing Winds, S.W.

A SUMMARY OF THE WEATHER.

A clear sky, $3\frac{1}{2}$; fine, with various modifications of clouds, $15\frac{1}{2}$; an overcast sky, without rain, $6\frac{1}{2}$; rain, $4\frac{1}{2}$.—Total, 30 days.

CLOUDS.

Cirrus,	Cirrocumulus,	Cirrostratus,	Stratus,	Cumulus,	Cumulostratus,	Nimbus.
24	13	25	3	24	25	17

A SCALE OF THE PREVAILING WINDS.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Days.
$4\frac{1}{2}$	2	4	$1\frac{1}{2}$	$3\frac{1}{2}$	$8\frac{1}{2}$	$1\frac{1}{2}$	$4\frac{1}{2}$	30

* The Report for the preceding month was transmitted to us by Dr. Burney, but unfortunately miscarried. We hope to be able to continue them regularly in future.

The first nine and the last five days of this month were dry, the other part was generally wet, yet the weather has been remarkably warm for the season, frequently sultry in the evenings and throughout several nights, insomuch that the mean temperature of the air this month is only 1 1-10th degree less than that of last month. The mean temperature of the external air this month is 3½ degrees higher than the mean of September for the last nine years. The temperature of spring water arrived at its *maximum* at the time of the autumnal equinox; and, in consequence of the dryness of the summer, and the unusually high temperature of the ground, its *maximum* for the present year is one-third of a degree higher than the mean of the *maxima* for the last five years. The steadiness of the mercury in the barometer at this period, arising from the gentleness of the atmospherical tides, as they are termed, is a proof the calmness of the weather. Should it be asked what this unprecedented mean temperature of the air is attributable to, we would answer, with deference, that it may have been influenced partly by the great heat of the ground, as ascertained by the temperature of spring water, and partly by the conjunction of the planets, as hereafter mentioned, and the recent appearance of the comets that are said to be pervading the solar system. For we have particularly observed, that the temperature of the air is comparatively higher when a comet is present, than when it has receded from the sight; and by admitting the theory of attraction of the planetary bodies, and the diffusion of light and caloric to them as well as to our earth, it is not irrelevant to suppose, that the conjunction of an inferior with superior planets may have a tendency to increase, in some measure, the heat of our atmosphere. Such a suggestion is certainly deserving the attention of the philosophic mind, though we admit it to be a subject hitherto uninvestigated.

The atmospheric and meteoric *phenomena* that have come within our observations this month, are three *parhelia*, one *paraseline*, two solar and two lunar halos, one rainbow, and one lunar iris on the 25th, the latter at 9 P. M.; twenty-four meteors, lightning in the nights of the 11th, 14th, and 20th; and thunder in the afternoon of the 14th; three strong gales of wind, namely, one from S.E. and two from S.W., the first of which came on the day preceding the autumnal equinox.

Singular Appearances of Meteors.—In the evening of the 4th instant, a large meteor passed from the star Alpha, in the constellation Aries, to the Pleiades nearly, and showed itself in this direction, mostly behind a wane-cloud.

In the evening of the 13th, at a quarter past nine o'clock, a brilliant meteor, of a whitish colour, in its descent from the star Atair, in Aquila, divided in two distinct parts just before it disappeared.

Conjunction of the Planets, &c.—Soon after four o'clock in the morning of the 28th, a conjunction of the planets Mars and Venus, and the star Regulus was observed here. These celestial objects were about 15 degrees above the eastern horizon, in the prime vertical, and the sky being cloudless at the time, made this interesting phenomenon very conspicuous. The distance of Venus from Mars was 44 minutes of a degree, and from Regulus 39′ 5″, all of them forming an isosceles triangle. Jupiter was 6° 33′ to the eastward of Venus; an occultation of Regulus behind Venus took place at six o'clock in the evening of the same day, and at 10 P. M. Mars and Venus were in their nearest conjunction, namely, two-thirds of a degree distant from each other.

At four o'clock in the morning of October the 4th, a conjunction of Venus and Jupiter was also observed here, when the former was distant from the latter 40 minutes. Venus, in this position, certainly appeared the most brilliant of the two, and reflected a greater light upon the Earth than Jupiter did. In the evening, Venus, when passing the southern side of Jupiter (although invisible to us), was only a few minutes distant from him.

TENACITY OF IRON, AS APPLICABLE TO CHAIN-BRIDGES.

The following results have been deduced from experiments made in Russia, and detailed by M. Lamb, in a letter from Petersburgh, *Ann. des Mines*, x. 311. In the apparatus contrived for the purpose the power was applied by a hydraulic press.

The best iron tried supported 26 tons per square inch, without being torn asunder. The bars began to lengthen sensibly when two-thirds of this power had been applied, and the elongation appeared to increase in a geometrical ratio with arithmetical increments of power. The worst iron tried gave way under a tension of 14 tons to the square inch of section, and did not lengthen sensibly before rupture. By forging four bars of iron of medium quality together, an iron was obtained which did not begin to lengthen until 16 tons had been applied, and supporting a weight of 24 tons without breaking.

Taking these results as sufficient data, it was decided by the committee appointed for the purpose, that the thickness of chains in a suspension-bridge should be calculated so that the maximum weight to be borne should not exceed 8 tons per square inch of sectional surface, and that, before being used, they should be subjected to a tension of 16 tons per square inch, and bear it without any sensible elongation.

HINT TO VARNISH-MANUFACTURERS.

Sir,—A thought lately struck me, that a strong iron vessel (something like Mr. Perkins's steam-generator, but much less) might be advantageously employed in the manufacturing of Varnish. Amber and copal make the best hard varnish, but they are exceedingly difficult to dissolve, owing to their requiring a greater heat than turpentine or spirits of wine will bear without evaporating. The latter, indeed, is so volatile, that I do not believe they were ever dissolved in it alone; and it is said, that only two or three persons in this country can make copal varnish properly.

As water, when confined, can be heated to almost any degree, I see no obstacle to hinder us from heating the usual menstruums of varnish in the same manner. They are more volatile, but we have only to make the vessel stronger. The gums, no doubt, would be better for being crushed and mixed with the spirit, before they were put into the vessel.

I remain, Sir,

Your obedient servant,

W——.

PRINTING PRESS INDEX.

Sir,—In Number 106, vol. iv., of your very useful Publication, I find an article respecting a Machine for counting the Number of Sheets pulled by a Printing Press. I beg to say, I made a machine for that purpose some years ago, and I have a working model of it by me at this time. The description is as follows:

It counts from one sheet to any number required; and there is a bell strikes at any given number, which gives notice to the person who takes off at the press that such a number is complete. It is not necessary this machine should be placed on the press, or in the press-room, as it will work in any part of the premises required. The insertion of the above will oblige

Your obedient servant,

J. Sharp.

Northampton.

CURE FOR SMALL-POX.

At a late Meeting of the French Royal Academy of Medicine, M. Velpean read a Memoir to prove that, if the pustules of the Small-pox are cauterised within the first two days after their appearance, they die away entirely; and if this be done even later, their duration is abridged, and no traces of them left. The caustic he employs is a solution of nitrate of silver, in which he dips a probe, with which he pierces the

centre of each pustule. M. Dumerel says that he has been long familiar with this practice, but, instead of the solution, he employed the solid caustic itself.

WHY DOES A RAZOR CUT BETTER AFTER BEING DIPPED IN HOT WATER?

Sir,—I shall trouble you with a few remarks on Mr. Pasley's paper, which, perhaps, you may deem worthy a place in your valuable Magazine.

His first explanation, on the most cursory view, appears quite erroneous, inasmuch as the obstruction on the sand-paper is occasioned not by any imperfection in the scissars, but solely on account of the sand; so the obstruction to the razor is in the beard. We know that a razor would go over the chin smoothly enough if the bristles were not there to interrupt it—the comparison does not hold good.

Mr. Pasley next tells us that fire is not *hot*. He appears to be one of that fanciful class of philosophers who would wish to convince men, against the evidence of their senses, that the qualities of heat and cold exist not in bodies themselves, but are merely incidental sensations arising no one can say how. Might he not as well tell us that a steam-engine is not at work when no one is present to be a witness of its movements? The one position will hold just as good as the other.

Mr. Pasley would wish us to believe that fire is only hot when felt, an absurdity too palpable to need serious refutation. If Mr. P. intends to say that fire is not the essence of heat, he is right; but to say it does not convey the feeling called *hot*, is ridiculous.

To return, however, to the question, Why a razor cuts better after being dipped in hot water? I would beg leave, before entering further upon it, to ask how it has been ascertained that a razor does cut better after that? This is, at present, a matter of doubt with me, for I know a very different reason why razors are dipped in water, which I may, with your permission, some day state; and, perhaps, the insertion of my inquiry will be the means of stopping a long and needless discussion.

I am, Sir,

Your very obedient servant,

T. M. B.

Sir,—I am rather at a loss to comprehend the meaning of Mr. T. H. Pasley, when he says that "the razor, before being dipped, has obstructions in itself to overcome," and does not explain what these obstructions are. I conceive that he merely repeats, in other words, that razors cut better when dipped than when not dipped, which is the fact required to be explained. As to the long story of fire being hot or cold, I can only reply, that the word heat is used to convey the idea of the effect of fire, and therefore fire may be said to possess heat or to be hot, in spite of the nice and subtle distinctions of Mr. T. H. P. I fancy that, if he would hold his finger in a candle for a minute, he would soon become convinced of its heat, *i. e.* of the cause residing in the candle, which produced a sensation on the sensorium. But this is more addressed to the writer than the subject: I myself think that the heat of the water, causing expansion in the metal, tends to equalize the uneven edge, and thus facilitates the important operation of shaving.

I am, Sir,

Your obedient servant,

Bingham. IGNIS.

Sir,—The answer of your Correspondent, T. H. Pasley, to the question of Novaculus, is, I think, a little far fetched. I have often thought on the subject, and have come to a conclusion that is quite satisfactory to my own mind; but if I should be wrong (which is not unlikely), perhaps some of your Correspondents will be kind enough to correct me.

The microscope enables us to discover that a razor set with ever so fine an edge, is, in fact, a saw, and the edge, which appears so smooth to the eye, is filled with teeth; now, the cutting of this instrument depends, as in all other toothed instruments, on the *sharpness* and *cleanness* of the teeth. A saw with a thick blade requires great labour to make it cut, but this labour is diminished in proportion to the thinness of the blade and the fineness of the teeth; but it is not only necessary, in order to its cutting smoothly, that the blade should be thin, but also that the teeth should be *quite clean*, and this is rendered more and more necessary as they decrease in size, so that, if the teeth are very small, the least thing will clog them up, and recourse must be had to some

means of clearing them. Now, if this reasoning is applied to the case in hand, I think it may be easily seen that an accumulation of fine particles of dust, some little remains of soap, and a trifling corrosion of the steel, will be quite sufficient to retard the cutting of a razor, although the razor may be sharp, and in this case I think nothing is likely so effectually to remove these substances as immersing the razor in boiling water; but hot water will not always clear the teeth, so that we are obliged to take the strap, and when neither hot water nor the strap will effect it, the edge is become thick, and recourse must be had to the hone.

Many people (and I think some of your Correspondents) seem to imagine that a bit of leather, after being rubbed with pewter, or a bit of cotton cloth, or an old stocking, contributes to the sharpening a razor, by acting in some minute degree in abrading off or reducing the thickness of its edge; but this I think is a great error—*the hone, and nothing but the hone, makes the edge thin and produces the teeth: the strap and the hot water clean out the interstices, and they do no more;* at least this is my opinion. Perhaps trying the razor with a *dry heat* would decide the question.

I am, Sir,
Yours respectfully,
SAMOHT.

THE PERPETUAL MOTION SEEKERS.

SIR,—Your Correspondent, Philo-Montis, has *rung me such a peal*, and so belaboured me with my own cudgels, that I declare I have not yet recovered from that state of vibration consequent on such an attack.

Now, Sir, as regards the motive which is so "very apparent," and the "cocks and springs," which I never mentioned a syllable about, can any one for a moment suppose, that after stating the defect of P. M.'s "little device," I should, at the next breath, attempt to build a "great" one upon the same rotten foundation? My intention was merely this, to furnish a simpler and less expensive mode of applying the same principle, and thus afford to any reader of the Mechanics' Magazine who might be unacquainted with the laws of fluids, &c. an opportunity of satisfying himself, by actual construction, of the inadequacy of the means to the end proposed, for I have known people who either could or would not be convinced of the fallacy of a favourite project but by experiment.

I am at issue with P. M. as regards his little device acting *for a time*—it would do no such thing; for how, in the name of wonder, could the ball which *escapes* round the corner, force itself from B to A without lifting the whole column of water contained in that leg, as the ball and tube are represented of the same diameter? Talk of preposterous, indeed! Here the word is explained in perfection.

I now take my leave of P. M.'s "little device" and "very small" valves, and next of their inventor, whom I can assure, *without chaffing*, that he has not given me the slightest offence either by the excellent pun respecting the "mighty Tom," or by the numerous extracts which he made from my paper, and fitted so expertly and judiciously into his text. I have only got one fear, that in consequence of his expressing so much warmth at being styled a *young man*, people may get into the other extreme, and set him down for an *old woman*.

Sir,
I once more subscribe myself
"under the name" of
T. BELL.

Commercial-road, Whitechapel,
October 10, 1825.

FIXING CRAYON COLOURS.

SIR,—The method given in page 381 of your 108th Number, for *fixing* crayons, might, and certainly would, "*fix*" them permanently; but from all that *I* have proved of the method offered (and I have used crayons forty years), I am so far authorised to tell you that the *colouring* (which is the main object of using any kind of paint) would be too much changed, especially the *high lights*, so as to render the method hurtful. I have frequently inquired into these sort of expedients, and, without one exception, have been answered, "it certainly will render the picture durable, *but spoils it*."

I am, Sir,
Your most obedient servant,
CHARLES HAYTER.

AMERICAN STEAM-BOAT.

The *Providence Journal* contains an experiment lately made of a newly invented engine on board the steam-boat Babcock, the name of the inventor, by which, at the expense of only one foot of wood, she accomplished a distance of 30 miles in three hours and a half. The machinery, it is said, occupies a very little room, and not more than a single barrel of water was expended in the passage.

INQUIRIES.

NO. 158.

IRON AND WOODEN AXLES.

Sir,—Whether does a cart with an iron, or one with a wooden axle, require most draught on a deep road? An opinion universally prevails among the carters of Northumberland, that the latter is more easily drawn on a deep road or up a bank, and that the advantage results from its greater thickness. This appears contrary to all reason; and yet, on the other hand, it is singular, if an opinion so general has no foundation in truth.

I am, Sir,
Your obedient servant,
J— W—.

NO. 159.

EMISSION OF LIGHT BY MERCURY.

Sir,—If a thin deal stops the opening on the top of an exhausted glass receiver, and mercury be poured on it, it will be forced through, and will fall into the receiver in a fine shower; and if the experiment be made in the dark, the shower will appear *luminous*. Now, how does mercury, in this instance, happen to give out light? If a bright metal is found to be made luminous by being agitated in vacuo, it will be important, as it will give us reason to *suppose* the heavenly bodies emit theirs on the same principle.

I am, Sir,
Your obedient servant,
J— W—.

NO. 160.

STEAM POWER REQUIRED TO RAISE WATER FROM THE THAMES TO PRIMROSE-HILL.

Sir,—It appears by a statement in one of the public Papers, that it is in contemplation to erect new water-works in the vicinity of Hammersmith, and that the reservoir of the same is to be on Little Primrose Hill, near Hampstead, and that the main pipe will be seven miles long, and will contain 1100 tons of water. I should feel obliged if one of your mechanical Correspondents would inform me (through the medium of the Mechanics' Magazine) what would be the power of a steam-engine capable of raising the above quantity of water such a distance, supposing the acclivity from the inlet at the Thames to the reservoir to be 130 feet?

By giving the above a place in your truly valuable Magazine, you will very much oblige,

Sir,
Your obedient servant,
A Member of a Mechanics' Institution in Kent.

ANSWER TO INQUIRY.

NO. 157.—MAKING BRONZE.

Sir—In answer to Inquiry No. 157, in your interesting Magazine, Number 110, I send your Correspondent, "H. S.," the very best method of making Bronze, which I have used for several years. Take spelter, and let it stand in spirits of wine for 24 hours; then pour off the solution, and let it evaporate, and boil it with three ounces, by measure, of sintum senega, for two hours; then take it off, and strain it through a fine rag, which will detain the fine powder, to be well washed with clear water, previous to using. The method of darkening the bronze is by simply adding chloride of ammonia, mixed with asphaltum; the mixture to be applied while hot to the brass or cop-

per: in short, I have successfully applied it to iron and steel. Should this merit a place in your Magazine, it may be of great use to your numerous Correspondents.

I am, Sir,

Your most obedient servant,

BRONZE.

NEW PATENTS.

J. F. Smith, Dunston-Hall, Chesterfield; for improvements in machinery for drawing, roving, spinning, and doubling cotton, wool, and other fibrous substances.—June 21.

J. J. Saintmare, Belmont Distillery, Wandsworth-road, Surrey, distiller; for improvements in distilling.—June 28.

D. Redmond, Old-street-road, Middlesex, engineer; for improvements in building ships, houses, &c.—June 28.

G. Thomson, Wolverhampton; for improvements in the construction of saddles.—June 28.

J. Heathcoat, Tiverton, lace-manufacturer; for improvements in manufacturing thrown silk.—July 6.

W. Heycock, cloth-manufacturer, Leeds; for improvements in machinery for dressing cloth.—July 8.

J. Biddle, Dormington, Salop, glass-manufacturer; for his machinery for making, repairing, and cleansing roads and paths, &c.—July 8.

Lieut. Molyneux Shuldham, Brampton Hall, Wrangford, Suffolk; for improvements in setting, working, reefing, and furling the sails of vessels.—July 8.

W. Furnival and J. Craig, both of Anderton, Cheshire, salt-manufacturers; for improvements in the manufacturing of salt.—July 8.

J. Day and S. Hall, Nottingham, lace-manufacturers; for their improvement on a pusher twist or bobbin-net machine.—July 8.

W. Hancock, King-street, Northampton-square, Middlesex; for improvements in the making of pipes for the passage of fluids.—July 16.

W. and H. Hurst, Leeds; for improvements in scribbling and carding sheep's wool.—July 16.

H. Hurst, manufacturer, and G. Bradley, machine-maker, both of Leeds; for improvements in looms for woollen cloths.—July 16.

T. W. Stansfield, merchant, W. Prichard, civil engineer, and S. Wilkinson, merchant, Leeds; for improvements in looms and in the implements connected therewith.—July 16.

T. Saddler, Devizes; for improvements in collars for horses and other animals.—July 16.

M. I. Brunel, Bridge-street, Blackfriars; for mechanical arrangements for obtaining powers from fluids, and for applying the same to various useful purposes.—July 16.

T. Sitlinton, Stanley Mills, engineer; for improvements in machinery for shearing or cropping woollen or other cloths. July 16.

J. Farey, Lincoln's Inn-fields, civil engineer; for improvements in lamps.—July 16.

T. R. Williams, New Norfolk-street, Strand; for an improved lancet.—July 16.

Lieut. T. Cook, Upper Sussex-place, Kent-road; for improvements in the construction of carriages and harness for the greater safety of persons riding.—July 16.

J. Cheseborough, dyer, Manchester; for a method of conducting to and winding upon spools, or bobbins, rovings of cotton, flax, wool, or other fibrous substances.—July 16.

W. Hirst, and J. Carter, cotton-spinner, Leeds; for an apparatus for giving a new motion to mules or billies.—July 16.

J. P. De la Fons, George-street, Hanover-square, dentist; for improvements in extracting and fixing teeth.—July 16.

J. Downton, Blackwall, Middlesex, shipwright; for improvements in machines or pumps.—July 19.

CORRESPONDENCE.

Communications received from—W. B.—L. F.—Paul Pry, Jun.—G. S.—D. Thomas—D. E. F.—W. C.—L. B. D.—A Mechanic—An Old Correspondent—B.—Felix—An Experimenter—Tyro.

*** *This Number concludes our Fourth Volume: the Supplement, containing Title-page, Index, &c. and a Portrait of* MR. PETER NICHOLSON, *the Author of many valuable Works on Architecture, &c. will be published on Tuesday, November the 1st.*

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